Industrial Refrigeration

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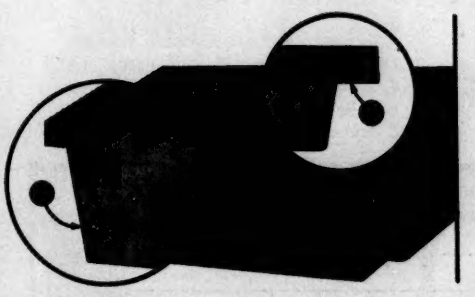

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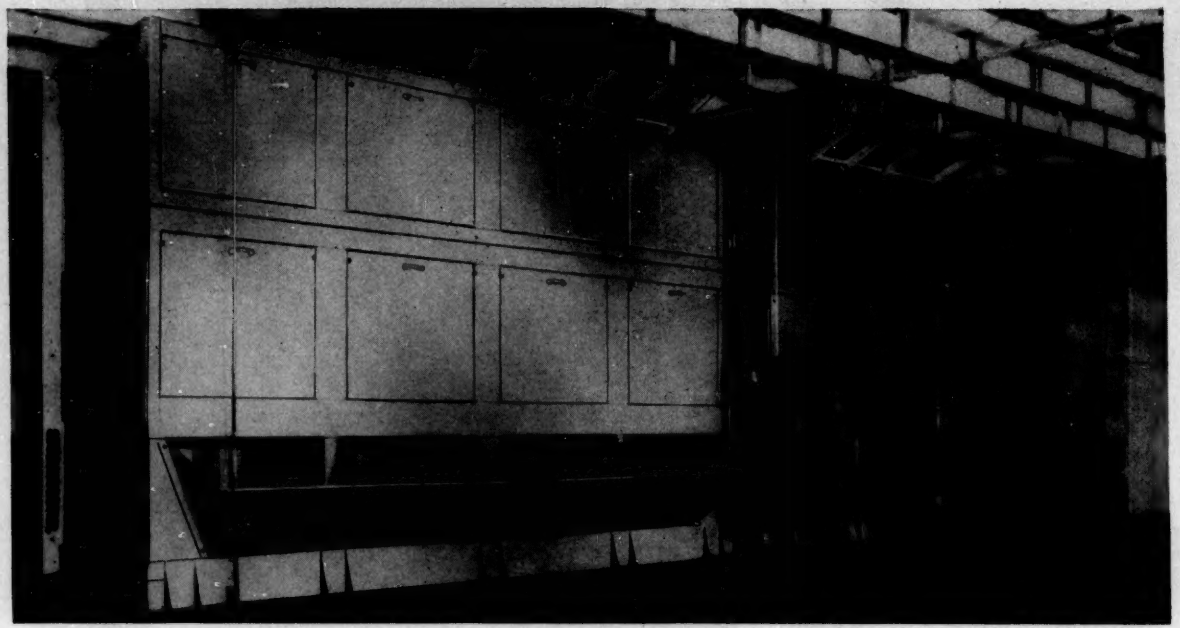

Quinton Holland, Goldring chief engineer at control panel. CONTRACTOR: Jennings Refrigeration, Inc., Los Angeles.

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A large custom floor unit was the answer and through Pacific Metals Co., western KRACK distributors, the order was placed with Refrigeration Appliances. The completed unit measures 37′ x 12′ x 5′ and was shipped just six weeks after the order was received. The unit is built in two sections, each delivering 55,000 cfm. Automatic defrost is alternated every 24 hours.

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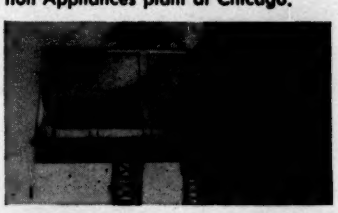
Unit required two trucks for shipping. Here one-half of unit leaves Refrigeration Appliances plant at Chicago.



Opening in wall of new addition at Goldring Packing Co., Los Angeles permits entry of each half of the huge Krack refrigeration units.

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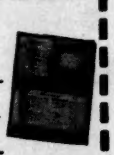

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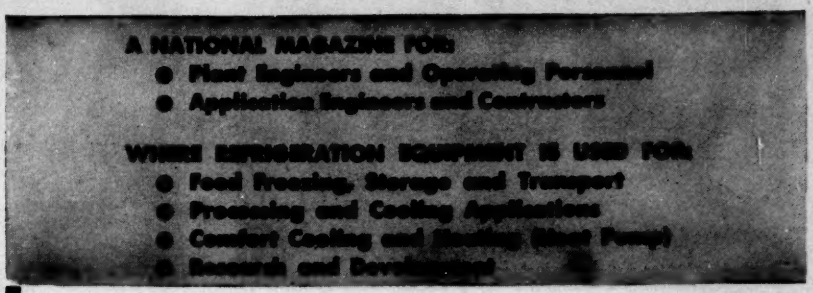
Industrial Refrigeration

May 1960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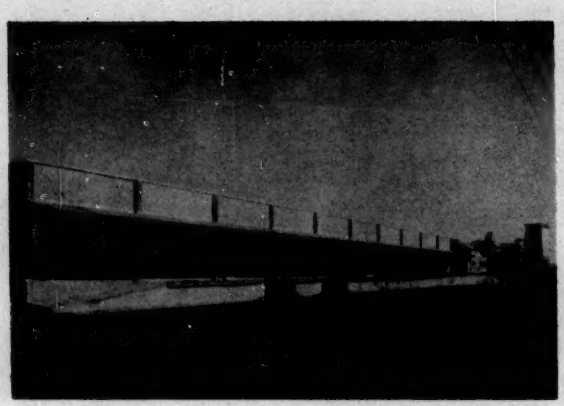
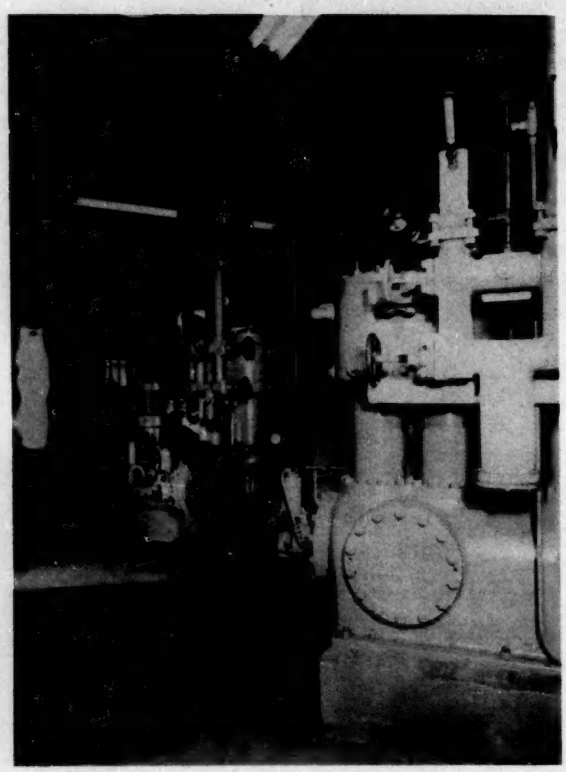


20,000 square feet storage area for Western Turkey Packing in Dinuba, will maintain constant 0° F to -10° F temperatures for up to 4 million tons of food. The 60 ton ice storage bin is seen at the right of the photo.

Inside storage room, two Kohlenberger 15-ton unit coolers mounted on the mezzanine above the load-out room, maintain temperature of -10° F. Each of two rooms can store 2 million pounds at this temperature.

Four Million Pound Turkey Storage

This view of the machineroom at Western Turkey Packing shows two 60 hp OLP compressors and one 100 hp KHD compressor.



»» A NEW turkey and chicken storage facility for the Dinuba plant of Western Turkey Packing Company, Division of National Storage Company has recently been completed by Kohlenberger Engineering Corp., Fullerton, Calif.

The original plant lacked sufficient sub-zero storage area to hold frozen turkeys, for shipment and ice-making equipment was not adequate to satisfactorily chill poultry before eviscerating.

Kohlenberger engineers designed and supervised construction of a 20,000 sq. ft. sub-zero storage warehouse adjacent to the existing building. The new facility is of 20 ft. high concrete tilt-up panel construction with eight inch insulation on walls and ceiling. The roof is half-inch plyscord covered with an all fiberglass life-time roofing. The floor features perimeter insulation with the major part of the building protected from freeze heaving by a network of piping in the fill. Oil is circulated through this piping at 70°F.

Two large storage rooms are located in the center of the new freezing warehouse. Total storage capacity is 4 million lbs.; however, the facility has been freezing approximately 3 million lbs. Above the storage rooms, on a mezzanine floor are located four Kohlenberger FCM 1400 floor type air unit coolers. Each room has two units to maintain the temperature at −10°F.

In order to supply adequate ice to chill the turkeys before eviscerating, a storing and dispensing system was designed to supply 50 tons of ice during an eight hour working day. The system consists of an ice storage bin with a 60 ton holding capacity and a 2 hp. ice rake. The rake serves as a leveling device at night and a means of dispensing the ice during the day. The enormous size required for a bin of this capacity made it necessary to locate it outside the old plant building. over the parking area.

One corner of the machine room of Western Turkey Packing Co's. Dinuba Plant showing two 60 hp boosters. Each of these units has a capacity of 70 tons at -35° F. Compressors are shown in another photo.

60 ton ice bin at Western showing Kohlenberger "Levelrack" ice spreader which maintains an even height of ice and dispenses the ice at any desired rate. Note the ice falling from ice makers above bin.

Plant Completed

Four 24 inch diameter holes were dug 22 feet deep. These were filled with concrete to form footings for 10 in. pipe columns. On these columns, rising 14 ft., the 16 ft. tall bin was constructed. Located above the bin are two Krakice makers which supply the ice. They are located inside a weather penthouse. Total height of the entire system is 40 ft.

The ice is taken from the ice bin by a 12 in. diameter screw conveyor which dumps the ice into table chilling tanks containing the poultry waiting to be chilled.

On the east side of the plant a railroad siding has been constructed and an aluminum covered truck loading dock is located on the west. The dock roof is a cantilevered "I" beam and joist construction covered with corrugated aluminum. Posts and columns have been eliminated for ease of product handling.

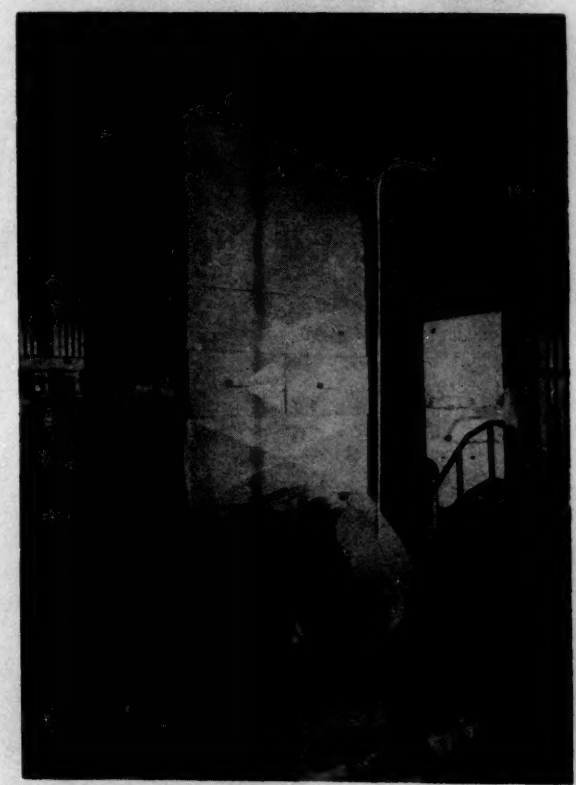
Emergency releases have been installed on the doors to prevent personnel from being locked in, and as a double safety feature, signal horns have also been incorporated into the safety program.

According to Dick Keefe, Western Turkey general manager, the plant is sharp freezing 125,000 lbs. a day. Keefe states that he's very pleased with the ice makers as they're operating at between 50 and 55 tons a day even though they're 40 ton capacity units.

The plant is currently operating in an 11 month schedule; however, Keefe indicates that begining in March, 1960, the facility will be operating on a year round basis. Currently 125 people are employed at the Dinuba plant.

Kohlenberger equipment incorporated into the new building includes: OLS —4 cylinder 10 x7½ 60 hp. booster; OAS —4 cylinder 7½ x 7½ 100 hp. high stage; KE —100 evaporated condenser; 36" Dia. x 16 ft. receiver; air cooled interstage desuperheater; sub-floor heat exchanger; FCM —1400 unit coolers; Krakice machine; ice rake; ice screw conveyor.

Krakice Maker one of two mounted above ice storage bin at Western Turkey is capable of making 40 tons of ice each day. However, in this installation each of the two is producing between 50 and 55 tons each day.



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ASHRAE To Meet In Vancouver

»» THE 67th Annual Meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. will be held in Vancouver, B. C., June 13-15.

The three-day program will include four Technical Sessions on topics allied with Absorption Air Conditioning, Refrigerants, Thermoelectric Effects and Heating.

There will be three symposiums covering domestic refrigerator engineering, commercial refrigeration and air conditioning.

The forms will, as usual, relate to immediate industry problems.

Headquarters for the meeting will be at the Vancouver Hotel. The usual officer and committee meetings will precede and parallel other events. The latter will include the Welcome Luncheon on June 13 when incoming officers are installed, the annual banquet on June 14, various trips to near-by points of interest and a special program for the ladies.

Demand For Space Promises Big Air-Conditioning Exposition

»» WITH the 15th International Heating & Air-Conditioning Exposition still ten months away, nearly 400 exhibitors have already engaged space in the International Amphitheatre at Chicago, where the display will be held, February 13-16, 1961. As heretofore, the big biennial event will be held under the auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, whose national meeting will be held concurrently.

The 1961 Exposition will be the most comprehensive ever held, with thorough coverage of the distinct and separate fields of industrial, commercial, institutional and residential heating and air-conditioning. Complete systems, unitized facilities, component parts, and materials will be well represented. Increased emphasis on refrigerating equipment will round out the display.

New equipment will reflect the balance of demand for contrasting methods of heating and air-conditioning, with forced air and hydronic systems continuing to show noteworthy improvements. Special attention will also be claimed by innovations in gas heating equipment and in the growing use of electric heating in favorable areas.

Central Station Air Conditioning Estimated $715 Million In 1959

»» INSTALLED cost of central station air-conditioning systems which went into operation in large multi-room buildings and commercial and industrial applications in the U.S. during 1959 is estimated at $715,080,000, compared with $604,130,000 in 1958, Air-Conditioning and Refrigeration Institute reported recently.

The ARI figures are based on shipments for use in the United States of compressors, condensing units, absorption systems, and centrifugal and reciprocating liquid-chilling packages of 25 horsepower and over. They do not include any figures for brine chillers or equipment utilizing ammonia as refrigerant.

Actual cost of the equipment included in the base is estimated at about 10 per cent of the installed value of central station systems. The remainder includes labor, ducts, controls, insluation, plumbing, and other installation costs.

It was pointed out that these big "systems", which gave most Americans their first taste of air-conditioning, still account for the largest share of the industry's sales.

news briefs of the month

Fresh Flavor For Canned Food

Canned foods with fresh food taste, based on flavor-enhancing method using flavor enzymes obtained from bruised fruit and other foods wastes, is new development of Evans Research and Development Corp. Patented process utilizes chemical nature of flavor. Fresh flavor is produced by catalytic action of specific enzymes on flavor precursors in natural foods.

Transport Tank Makers Can Get Amended 3-A Standards

Standards for stainless transportation tanks for bulk delivery or farm pick-up service which has been amended and approved by conferees at the most recent 3-A Sanitary Standards Committee meeting may now be secured in multilith form by manufacturers of transportation tanks from Dairy Industries Supply Association, Technical Officer, 1145 19th St. N.W., Washington 6, D.C. The amended standard is to be published soon but until publication the multilith form may be obtained. The Sandard becomes effective July 5, 1960.

Don't Store Carrots In Apple Storage

Don't store carrots near apples or where apples have been unless the air, walls, ceilings and floors have been cleaned to remove all traces of apple volatiles says The Refrigeration Research Foundation and the New York State Association of Refrigerated Warehouses. It has been found that the by-products (volatiles) of apples cause flavor changes or bitterness in carrots in contact with apple volatiles. The causative agent can move from room to room within a storage building unless the walls are air tight and entrances to the room are so situated that gas cannot pass from one room to another.

Holding Temperatures For French-Fry Potato Strips

Pre-peeled raw French-fry strips are highly perishable and have a short shelf-life at warm temperatures. An adequate shelf life can be obtained only through refrigeration at 40°F or lower. Potatoes in a non-perforated polyethylene bag maintain an overall better appearance than those in perforated bags. Weight loss is negligible in either case. Potato strips stored 8 to 12 days at 40°F or 32°F do not darken during frying to any greater extent than freshly prepared strips from potatoes stored at 55°F. More data on the subject can be obtained from the paper by R. E. Anderson in the American Potato Journal, November 1959.

Management Course Graduates 27

The Management Development Course conducted by the Ice Cream Merchandising Institute under the co-sponsorship of American Dry Milk Institute, Colorado Dairy Products Association, Dairy Industries Supply Association, International Association of Ice Cream Manufacturers, and Milk Industry Foundation, recently presented certificates to 27 dairy industry leaders on completion of the training activity. These men had previously completed the first week's part of the program and session held in the State College, Pennsylvania, and Granville, Ohio.

Freeze-Dried or Dehydro-Frozen Foods Need Frozen Storage

According to Dr. Walter A. Maclinn, Director, The Refrigeration Research Foundation, the term "freeze-dried foods" is frequently applied to dehydro-frozen foods and vice versa, but it shouldn't be. They are actually different types of foods prepared by different techniques and designed for different purposes. As the name dehydro-freeze implies, the food is first dehydrated and then frozen for storage and shipment. The dehydration process is the conventional one of applying heat to drive off the moisture, just the same as for dried eggs, milk, etc. However, the food is not completely dehydrated. Approximately 40% of the weight of the food is removed by dehydration. Since the food is only half dehydrated, it is still perishable and, therefore, has to be frozen for holding and shipping, to prevent spoilage.

As for the freeze-dried foods, the product is first frozen and then dehydrated. The food is frozen unpackaged and then a slight amount of heat is applied in the presence of an air current, and dehydration occurs. Freeze-dried foods are dehydrated to a low moisture content and as such are not perishable in the same sense that dried milk and dried eggs are not perishable. However, to maintain the good quality of the product, and for easy rehydration, low temperatures and controlled humidities for storage and shipment will be needed.

Cyclomatic Vertical

Fig. 1—Cyclomatic Freezing Systems, a division of The Texstar Corporation, has installed the frozen food industry's first completely automatic and continuous freezer at the Costa Ice Cream Co., Woodbridge, N. J. The conveyor at left comes directly from the ice cream carton filler. The short conveyor in the foreground feeds the soft half-gallon cartons to the "escalator" conveyor to the right, which carries the cartons to the top of the Cyclomatic. There, they are automatically fed into the freezing channels, discharged at the bottom of the unit. Conveyor at top is a secondary one for carrying frozen cartons into the cold storage room if desired.

A New Machine Makes Its Debut

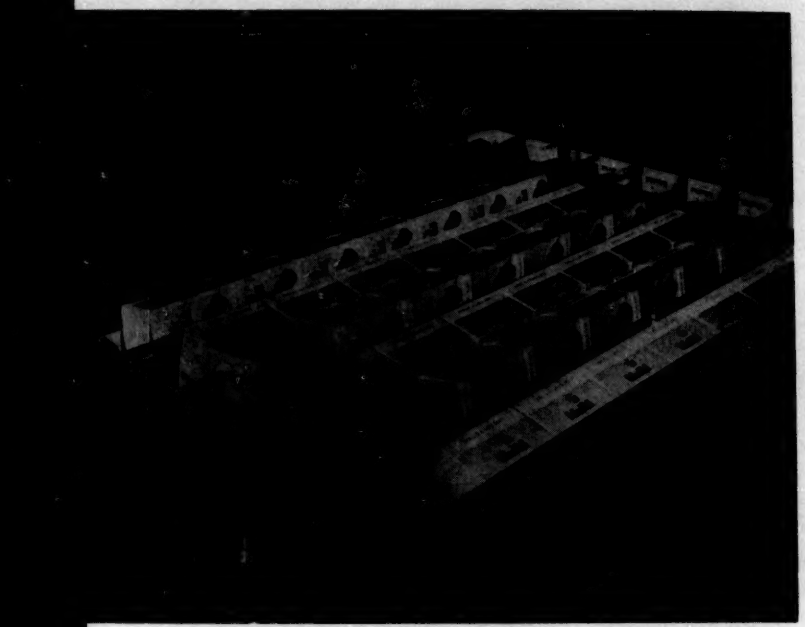


Fig. 2—Soft, half-gallon cartons of ice cream are shown being fed onto ready rails above the freezing channels of freezer. As soon as the ready rails contain a full load of 144 half-gallon cartons, which takes about five minutes, the freezing channels will open and all 144 cartons will move within the freezing channels and an equal number of frozen cartons will be discharged at the bottom. The opening and closing of the channels takes approximately three seconds. Operating in normal room conditions of temperature and humidity, the Cyclomatic freezer automatically and continuously hardens over 1,600 cartons per hour.

Fig. 3—Frozen half-gallons of ice cream are being discharged from the new automatic and continuous vertical-plate freezer. These cartons entered the top of the freezer less than an hour before, and will next be conveyed through an automatic wrapper and directly into a refrigerated truck for immediate delivery. Approximately every five minutes a complete layer is fed into the freezer at the top and the bottom layer is lowered into discharge position. The system is equally applicable to processors of other frozen foods such as fish, fruits, vegetables, meat and poultry.

Freezer Hardens Continuous Stream of Packaged Ice Cream or Food

»» COMPLETE mechanization along with operating economy and versatility in the frozen foods industry became a reality recently when Cyclomatic Freezing Systems, a division of The Texstar Corporation, unveiled their first Cyclomatic freezer installation at the Costa Ice Cream Company in Woodbridge, N. J.

Installed in low-cost space formerly used as a loading area, the machine continuously and automatically hardens half-gallon cartons of ice cream at a rate of over 1,600 per hour. The cartons come in a steady stream on a conveyor from the filler room to the top of the Cyclomatic where they are automatically cycled between freezer plates.

Emerging at the bottom the ice cream cartons are discharged onto a conveyor which carries them to a nearby automatic wrapper, where two half-gallon cartons are wrapped to form a gallon package. These are then conveyed directly into one of Costa's refrigerated trucks for immediate delivery. Only two people, one at the ice cream filler to feed cartons to the filler and one in the truck to properly load it, can continuously harden ice cream at from 800 to 1000 gallons per hour.

According to F. H. Garcelon, general manager of Cyclomatic Freezing Systems, "The same benefits are applicable to processors of other frozen food products such as fish, fruits, vegetables, meat and poultry. The secret of Cyclomatic's fast freezing ability is the use of vertical freezer plates flooded with refrigerant, which are in intimate pressure-contact with the product packages to obtain maximum practical rate of heat transfer." Thermal efficiency is claimed to be up to 40 percent greater than other known commercial freezers.

During operation Cyclomatic contains 1,872 half-gallon cartons within six freezing channels, 24 cartons long and 13 cartons deep. Approximately every five minutes a complete layer of 144 cartons is fed in at the top while a complete layer is discharged at the bottom. This feed and discharge operation takes only three seconds.

Because the machine operates under normal ambient conditions of temperature and humidity, and does not require an insulated enclosure, it can be installed anywhere that conveyors, refrigerant and electrical lines can go, including outdoors if desired. Cyclomatic Freezing Systems does not sell its freezer, but installs it on a lease arrangement, based on the food processor's annual volume.

How It Works

The equipment is the only type of unit on the market that optimizes pressure in conjunction with vertically disposed low temperature contact plates to effect rapid and uniform heat transfer in a non-refrigerated operating area. The principles of its design and the methods of its operation make possible this unique position.

The model in use at Costa is unitized and skid mounted resting on a floor space of 21′ x 8′ and extending to a maximum height of 10 feet. It weighs approximately 37,000 pounds of which better than 50% consists of seven freezing plates which provide six freezing channels 168″ long and 65″ deep or 910 square feet of freezing surface.

The capacity of the machine is approximately 5,000 pounds of product per hour but varies depending on the temperature that the user can supply to the plates, the product being frozen, its incoming temperature and desired temperature at discharge, the package size and other related factors.

Design Considerations

The rate of heat transfer is affected by the degree of intimacy between the source (the product) and the receiver (the refrigerant). The greater the intimacy the faster the rate of freezing.

Obviously, it has not been feasible to date to expose food or dairy products directly to the refrigerant. Hence there is a container for the

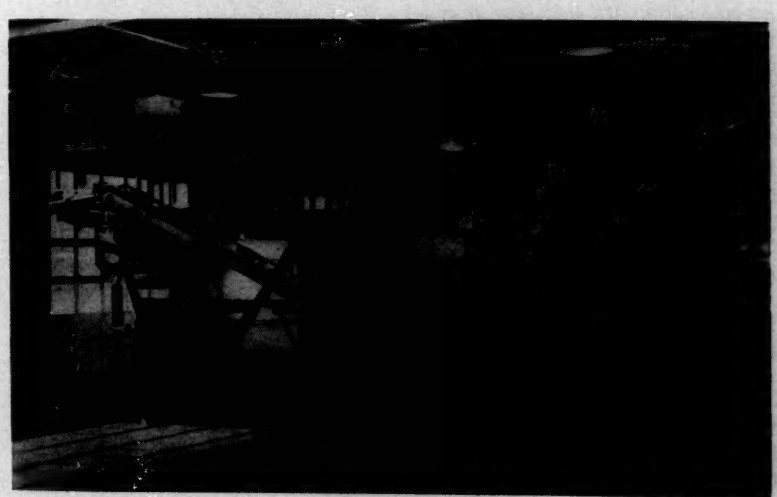


Fig. 4—Half-gallon cartons comes from the filler room on the conveyor just below office window in background. The packages are automatically fed onto the top of the Cyclomatic where they enter the freezing channels. Emerging at the bottom, the cartons are conveyed to the automatic wrapper in right foreground, where they are wrapped in packages of one gallon each and picked up by the conveyor in left foreground. This conveyor goes through overhead door at left to truck. Same conveyor also circles around the Cyclomatic to convey packages to cold storage if desired.

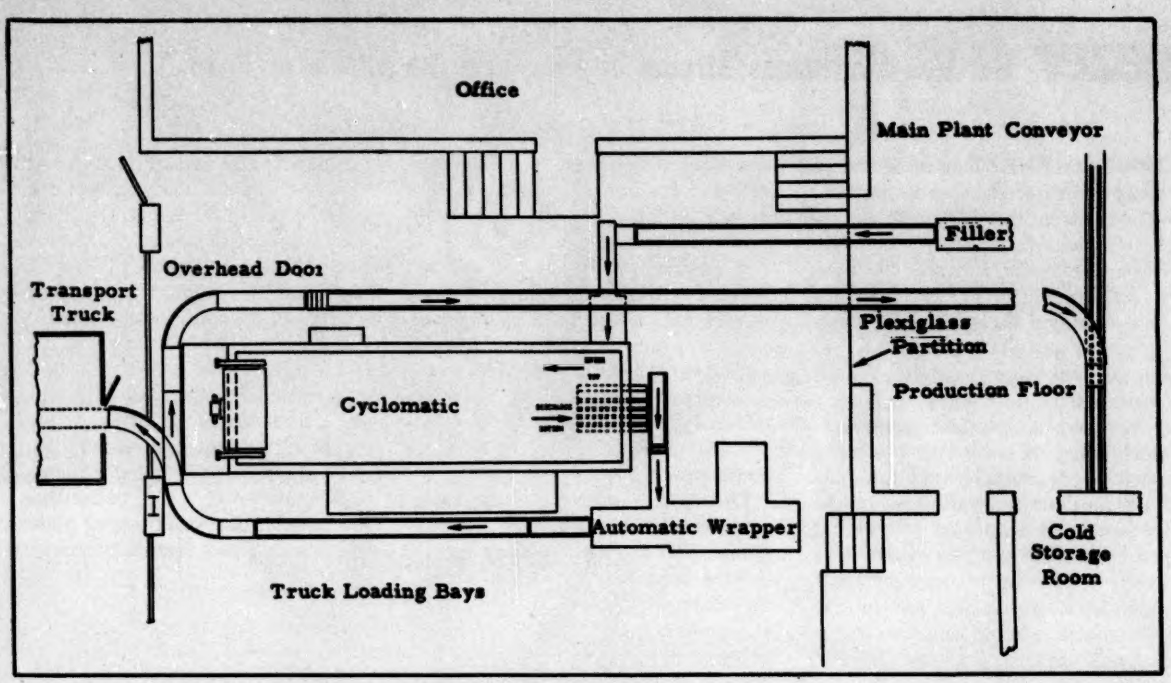


Fig. 5—Flow diagram of automatic and continuous freezer installed at the Costa Ice Cream Co. The Cyclomatic unit utilizes low-cost space formerly used as a loading area. Note arrangement to load directly into truck for immediate delivery.

refrigerant and generally frozen foods and frozen dairy products are also enclosed in a container. These containers are insulators which reduce the intimacy of contact.

Further insulation between the product and the refrigerant is introduced when (1) gas forms in the refrigerant container as heat is withdrawn from the product and (2) when air space or head space is required in the product container to permit expansion of product that will not expand within itself as does ice cream.

When freezing is accomplished by convection, the intimacy of contact is further reduced as volumes of air must be circulated past the refrigerant container and transmitted varying distances, to the product container where it accumulates heat which is then retransmitted to the receiver. Very often the temperature split between the air at the receiver and the air at the product can be 10° or more.

Thus in designing the Cyclomatic unit, consideration was given first to eliminating the temperature split found in the convection method. This indicated a unit which would freeze by conduction; that is the refrigerant container in contact with the product container.

Effect of Plate Position

Plate freezing by conduction has been in use for a number of years but the plates have been disposed in the horizontal plane. This position detracts from the degree of intimacy of contact between the source and the receiver for two reasons. First gas entrained in the lower plate under the product container being lighter than the refrigerant accumulates in the upper portion insulating the product container from the refrigerant. Secondly, the upper plate resting on the top of the product container is insulated from the product by the air-space provided within the product container for expansion. (See Fig. 6)

In an attempt to reduce the insulating effect of the gas, horizontal plate designs employ continuous coils which carry the refrigerant between the freezing surfaces of each plate. A pump with power forces the refrigerant through the coils at a rapid rate to carry the gas off more rapidly. This is known as a re-circulating system.

While this system reduces the insulating effect of the gas, it increases the cost for auxiliary equipment and power for pumping and also for the volume of refrigerant required to operate. In addition, it sets up two other areas of insulation: (1) the walls of the coil itself and (2) the coil walls are in contact with 50% or less of the freezing surfaces of the plates depending on whether round or rectangular tubing is used. Thus a secondary heat transfer is introduced which reduces the efficiency of this system. (See Fig. 7)

In the Cyclomatic design the insulating effect of the gas is eliminated without the disadvantages of the re-circulating system. The freezing plates are constructed of a series of 56 rectangular tubes 2″ x 3″ x 65″ long which are open at both ends. These are welded together in a vertical position to form a plate 65″ high and 168″ long. Thus the tubes themselves form the freezing surfaces of the plate. A horizontal 2″ x 3″ liquid feed header is welded along the bottom of the plate to permit the liquid refrigerant to be fed evenly into each vertical tube.

A float valve prevents the liquid level of the refrigerant from rising above the level of the top of the tubes. A horizontal 2″ x 5″ suction header is welded along the top of the plate. As heat is withdrawn

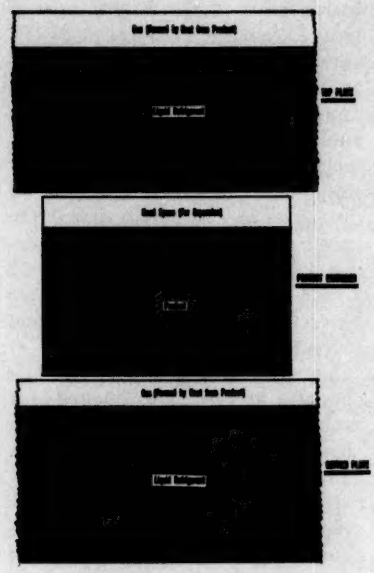


Fig. 6—Insulating effect of gas and head-space with freezing plates in horizontal position.

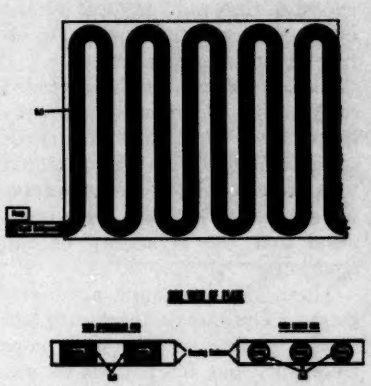


Fig. 7—Insulating effect of a re-circulating refrigerant system in freezing plate.

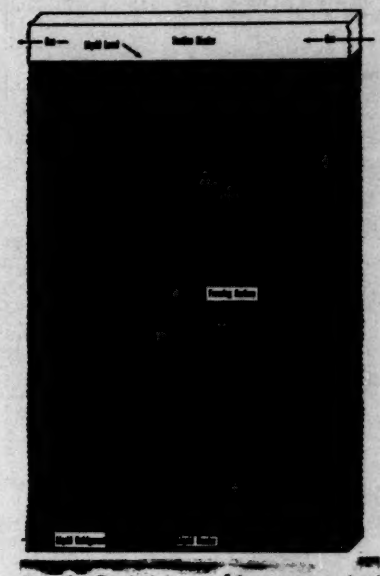


Fig. 8—Optimizing refrigerant contact with freezing surface by vertical plate and full-flooded system.

from the product, the gas that is formed in the liquid in the tubes rises to the suction header where it passes off to an accumulator. This is known as a full flooded system which is more efficient and less costly to operate than a re-circulating system. (See Fig. 8)

Effect of Package Position

To reduce the insulating effect of the air inside the product container where head space is required for expansion, Cyclomatic's vertical plate system permits a substantial increase in the surface area contact between the product and the walls of the container that are in contact with the freezing plates. In the following example this surface contact is increased by 80%. (See Fig. 9)

Thus the vertical position of the plates permitting a full-flooded system, plus the vertical position of the product package allowing greater surface contact reduces the insulating factors to a minimum thereby increasing the intimacy of contact between the product and the refrigerant and hence the rate of freezing.

Effect of Pressure

Intimacy of contact is not dependent on contact alone. This can be demonstrated best by placing your finger lightly on a hot stove and comparing your reaction to that you receive when you apply more pressure. Hence the application of pressure can increase the intimacy of contact and improve the rate of heat transfer.

Cyclomatic was designed to obtain this desired pressure at an increasing rate as the product is cycled through the machine during the freezing process. To accomplish this, the freezing plates must be planiform and the hydraulic pressure applied uniformly throughout the freezing areas. Thus as the cartons become harder when they cycle through the machine from top to bottom, they try to expand

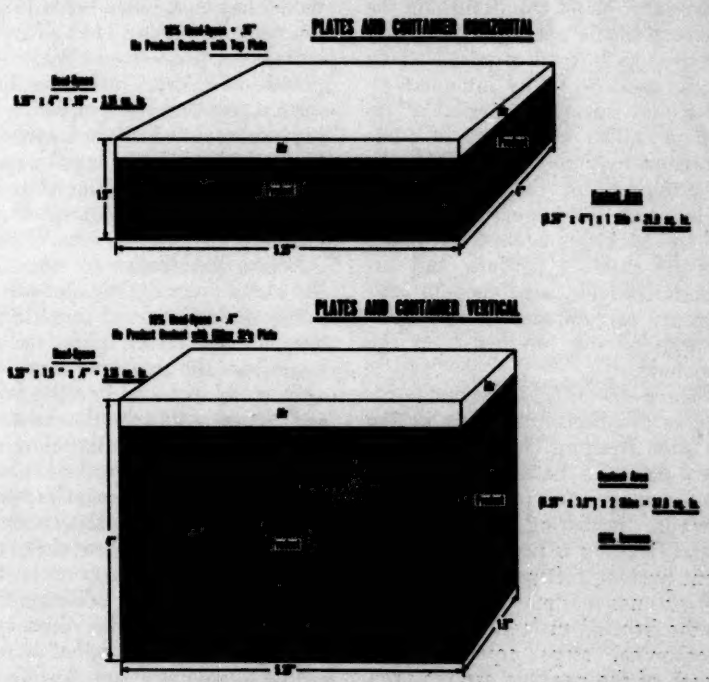


Fig. 9—Comparison of product contact with walls of containers that are adjacent in freezing plates.

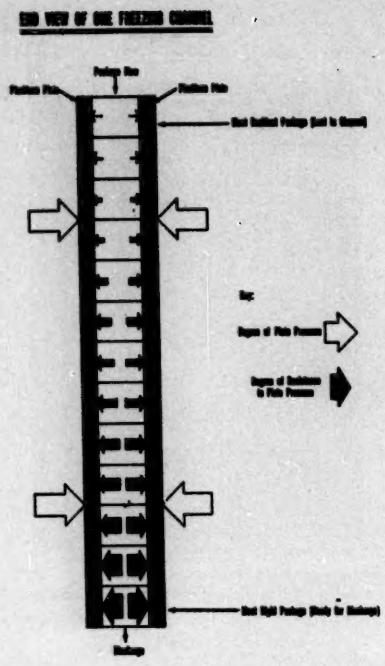


Fig. 10—Effect of pressure in vertical plate design.

thereby increasing the pressure they exert in opposition to the applied pressure of the plates. (See Fig. 10)

The lower layers of rigid packages within the plates prevent the planiform plates from crushing the more resilient packages that enter at the top, but still permit shaping each package to its intended dimensions during its period of resiliency. The uniformity of plate pressure over the entire load, the planiformity of the plates themselves and the increasing pressure of the packages against the plates as the product hardens and expands, provide assurance of uniformity of temperature upon discharge of the product from the machine.

These advantages are not possible in the horizontal plate design as each freezing channel between two plates is batch loaded with soft packages that may or may not contain insulating head space. Batch loading is necessary to prevent pushing soft packages against frozen ones that may have adhered to the freezing surface. In addition, mechanical stops equal to the depth of the package are required to prevent crushing.

It was found that batch loading of each freezer channel necessitated the cold plates being exposed to the air for an extended period of time. Consequently, unless the unit was housed in a low temperature enclosure, frost would form on the plates during this period of exposure thus reducing the intimacy of contact with its resulting effect on the freezing rate.

Also, insulated and refrigerated enclosures are expensive and any mechanical, electrical or hydraulic sub-assemblies or parts are required to operate at sub-zero temperatures which adversely effect their operation and the reliability of the equipment.

These disadvantages are overcome in Cyclomatic's vertical plate design by opening the plates more frequently but for periods of less than 5 seconds on each occasion. The elapsed time between each opening will vary depending on the setting of the timer that determines the length of the freezing cycle for the various products and package sizes.

This was accomplished by providing "ready-rails" directly over the freezing channel and on which are accumulated a full layer of packages during the period that the plates are closed on the layers being frozen. For example, the model in use at Costa holds 13 layers, each containing 144 half-gallon cartons of ice cream. While the plates are closed on these 1,872 cartons, another layer of 144 is being accumulated by a continuous feed which pushes six cartons at a time for twenty-four times into the ready-rails above the six freezing channels.

When the ready-rails are full, the plates open slightly and an elevator under each channel raises the thirteen layers, picks up the layer from the ready-rails and lowers the 14 layer load into the freezing channels to a level where the bottom frozen layer is below the plates. The up-action of the elevators shears any adhesion between the packages and the freezing plates. The plates then close and a cross shear mechanism at the bottom clears any adhesion between the layer to be discharged and the bottom layer that is now within the plates.

The elevators continue their downward motion, lowering the frozen layer to the discharge position. Discharge belts on each elevator go into motion and the frozen packages are ejected six at a time for overwrapping and conveyance to a cold storage room or directly into a transport truck for shipment if desired. The rate of discharge can be set to match the speed of the infeed and the freezing cycle to provide a continuous flow. Or the rate of discharge can be accelerated to provide rest time to loaders or palletizers.

Since the cold plates on the Cyclomatic freezer are opened for such brief periods, frost has no chance to form even on the hottest and most humid days. This eliminates the need for an expensive insulated enclosure, permits the equipment to be located on the least expensive floor space and allows the unit to operate at normal temperatures which will reduce maintenance troubles and costs and increase reliability and up-time.

Effect of Fast Freezing

Now a word about the condition of the product itself when it is discharged from the Cyclomatic. Remember that the carton cycles through the machine with its two largest sides in intimate contact with the low temperature pressure-plates and that heat flows from the area of highest temperature to the area of the lowest. Thus the heat within the package moves in two directions at an equally rapid rate toward the cold plates that form a freezing channel. This bi-directional flow of heat rapidly lowers the temperature on the two largest walls of the product that are adjacent to the plates.

If the product remained between the plates a sufficient length of time the temperature throughout the mass of the product would stabilize at nearly the temperature of the plates themselves. However, this is not necessary providing the temperature at the walls of the product is sufficiently low and has penetrated sufficiently toward the core. Under such conditions, when the carton is removed from the machine and placed in a sub-zero storage room or transport truck, the higher temperature at the core will continue to flow to the low temperatures at the walls so as to stabilize the temperature of the entire

mass at the desired level. Stabilization of the temperature within each carton will occur in one hour or less after discharge depending on the product and thickness of the package.

This action is best illustrated by a graph of thermocouple readings on the freezing of ice cream in a half-gallon carton. (See Fig. 11). The wall readings are from inside the package at the wall of the product mass adjacent to the freezing plate. The core readings are at the center point of the product mass and the median readings are at the point midway between the wall and the core. You will note the rapid fall initially of the wall temperature, the less rapid fall at the median and the apparent reluctance of the temperature at the core to change. However, this wide temperature differential sets up a heat transfer reaction that continues after the package leaves the machine.

In effect, each package becomes its own freezing unit with maximum intimacy of contact. The frozen walls act as the receiver or refrigerant which is in direct contact with the warmer product in the core. The excess heat at the core is reduced until the temperature of the entire mass is equalized. Hence, the temperature at the core upon discharge is not as important as in slower methods of freezing as long as the temperature on the walls is low enough and penetrates sufficiently toward the core to result in the desired stabilized temperature. This permits close stacking in the truck or in storage because air space around the carton is not necessary to continue the freezing process.

Good Texture

Finally, but by no means of least importance, Cyclomatic's rapid freezing rate improves quality. For example, small crystals within ice cream are the source of its smoothness or "mouth-feel" and body. If the ice cream is frozen slowly, these crystals expand and join together resulting in loss of the smoothness. Cyclomatic, through rapid freezing, creates a micro-crystalline structure within the product which improves the smoothness for better flavor release.

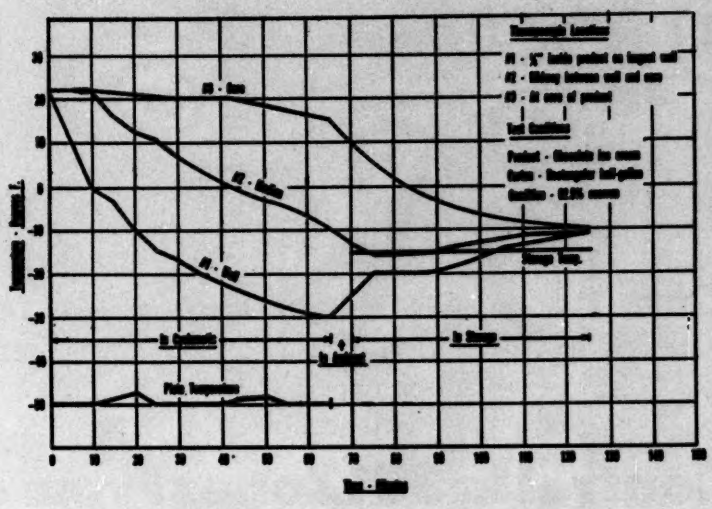


Fig. 11—Cyclomatic freezing rate of heat transfer graph.

The User's Point Of View

The techniques of manufacturing ice cream have improved over the years. However, the hardening of ice cream packages has not kept pace with the improvements that have been made in the other phases of ice cream manufacturing The Cyclomatic vertical plate hardener represents the first real step forward that has been made in the hardening process of ice cream.

It is true that some attempts have been made to increase the freezing rate by use of blast tunnels (another form of convection) and large plate hardeners operating in sub-zero temperatures. These attempts, while they may have produced the results desired, were extremely costly in both capital outlay for space, equipment, buildings and insulation and in operating costs for power, refrigeration and maintenance.

When we consider what must be earned on the invested capital, every expenditure that would increase that capital is given close scrutiny. Any producer making millions of units a year must revise the old saying of "Watch the pennies and the dollars will take care of themselves" to "Watch the mills and the pennies will take care of themselves".

Each year, the consumer is buying a larger percentage of his ice cream in half-gallon containers as more and more families have zero storage available in their homes. Prediction for 1960 is that half-gallons will represent 60% of the total industry sales.

The consumer has been educated to expect a better price if he buys in volume. The retailer benefits as he has a higher dollar sale per customer for the product. The producer of ice cream, however, processes in volume and may save a little in package costs but the balance of his ingredients still cost him the same. Hence he must look for economies in other areas such as handling, storage space, refrigerant and power costs and transportation.

Cyclomatic equipment will fill the gap in processing procedure in order to produce the economies necessary to be competitive in this changing and expanding market. The unit can be located in space which at today's prices might cost $4 to $5 a square foot as opposed to $35 to $50 per square foot of space in the cold room.

The Cyclomatic unit contains its own hydraulic system. Its power requirements are light, needing about 16 hp for one hour while loading the plates and about 5 hp per hour during the balance of the day.

The cost per package for hardening in the Cyclomatic unit will remain fairly constant and thus controllable. In adition, the unit represents standby capacity that is available when needed to meet peak demands.

Cyclomatic's rental policy is at-

Continued on page 27

Control In 301 Zones From a Control Panel

»» THE California Division of Highways has recently completed a new office building of lift-slab construction with tinted glass, curtain-wall skin. In contrast to its existing office building which was controlled by a ten zone air conditioning system, the new building has 301 air conditioning zones with air supplied at high velocity to Barber-Colman CVO constant volume mixing boxes. These mixing boxes, serving all 301 zones, serve the purpose of tempering the zone supply air, and at the same time, maintain the required air volume regardless of static pressure changes within specified limits, and attenuating fan noises so as to maintain quiet office areas.

Cooling is supplied by two Trane 350 ton Centravac units and two Cleaver Brooks boilers are used as the heating media.

The entire air conditioning system for the new building, as well as the smaller existing office building, is controlled by a schematic control center (See front cover) located in an office of the new building. All graphic illustrations depicting the many fan, refrigeration, heating and air conditioning systems employed throughout the building are graphically illustrated by a silk-screened process on a gold anodized aluminum background. Thus, the control and remote operation of 14 separate mechanical equipment rooms is centralized in one location. The following features have been incorporated into the master schematic control panel:

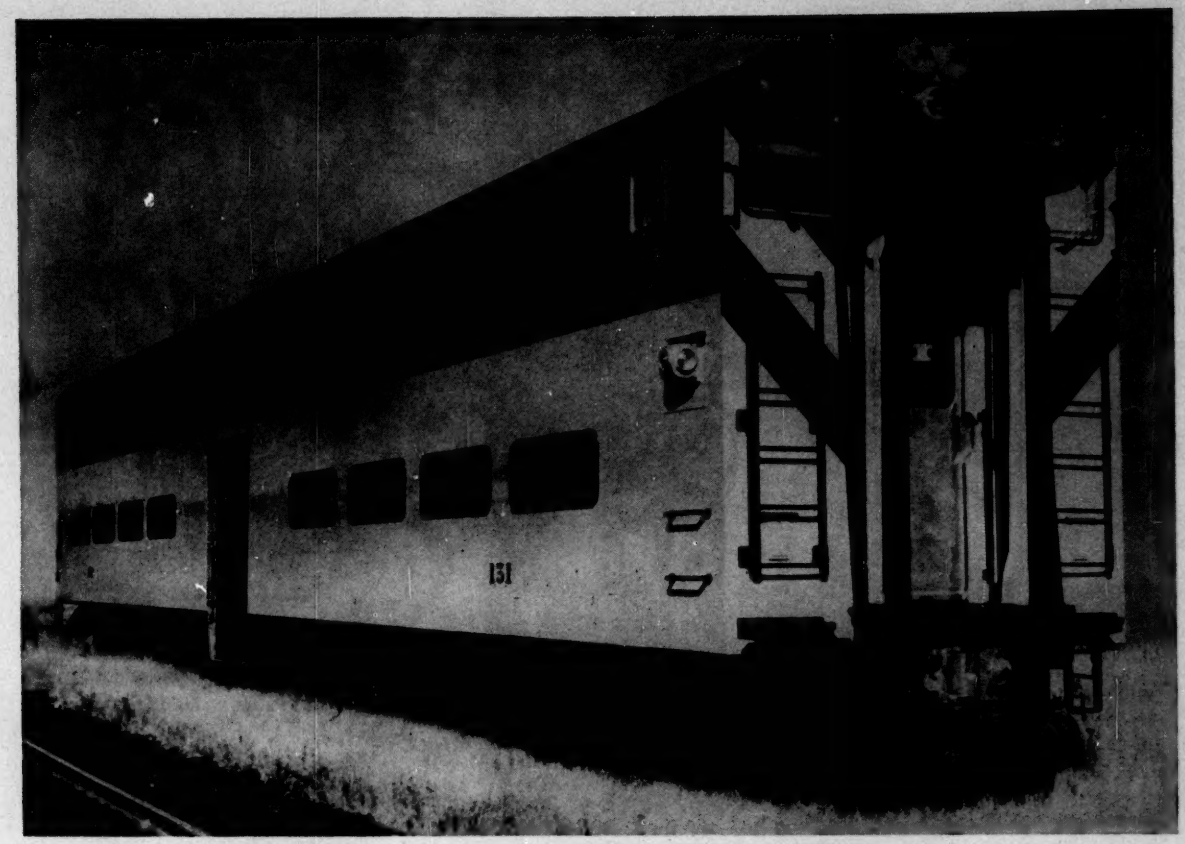
1. Time switches automatically pilot the operation of the equipment in both buildings.
2. The supply fans of each system are started in sequence through a program switch to reduce the starting load.
3. Hand-Off-Auto swtiches override the automatic control to start and stop any supply or exhaust fan, or the refrigeration system of the new building, which includes the chilled water pumps, condenser pump and cooling tower fan.
4. Pilot lights indicate operation of each of the previously mentioned items and also all hot water pumps, oil pumps, boiler burners and all compressors.
5. The existing building room thermostats have been modified so that the control point can be remotely adjusted.
6. The hot and cold deck temperatures of the 8 fan systems in the new building can also be remotely adjusted from the control center.

The electronic cold plenum controller proportions the return air, outside air and exhaust dampers in sequence with the chilled water valves, yet provisions have been made to override the cold plenum control of the dampers should the outside air temperature rise above the predetermined setting. Switches in the control center also provide for an override of the controls so dampers close manually.

A multiswitch resistance bulb temperature indicator serves to check 35 various temperatures throughout the building, including all hot and cold plenum temperatures, space heating hot water supply and return, space cooling chilled water supply and return; domestic hot water, drinking water supply and fan discharge temperatures of each fan system in the old and new buildings. Relative humidity can be determined from the outside air wet and dry bulb recorder. Boiler flue gas temperature is indicated on a Pyrometer. Flow conditions of the space heating hot water, space heating chilled water and condenser water are recorded in gpm on miniature strip chart recorders. Pressure gauges provide a constant visual check of the operating pressures of the space heating hot water supply, domestic water supply, existing building steam boilers and the suction and discharge of all compressors. The entire system is monitored by a warning light and buzzer control to indicate immediately unsafe conditions should they occur at any point throughout the entire system.

Other additional features of the new building are:

1. Smoke detectors located in all return air ducts used for fire protection.
2. Plenum temperatures reset in accordance with the velocity in the duct.
3. Roll-type, viscous-impingement filters are used on all fan systems with charcoal activated carbon filters used on all outdoor intakes.



232 self-contained units will air condition 116 of these new bi-level, "push-pull" commuter cars. The cars are being built by Pullman-Standard for the Chicago and North Western Railway. They will wind up a C&NW commuter service program representing an investment of $43 million.

116 New C&NW "Push Pull" Commuter Cars To Get 232 Air Conditioning Units

»» TWO hundred and thirty-two self-contained air conditioning units will be used in 116 new bi-level "push-pull" commuter cars being built for the Chicago & North Western railway.

The new bi-level commuter cars will be built in the South Chicago plant of Pullman-Standard within the next 16 months. The cost will be approximately $21 million, and the purchase is reportedly the largest of its kind in the history of American railroads. The C&NW is the only American railroad presently building commuter cars that include air conditioning.

All cars will operate on the push-pull principal which reduces slow turn-around operations by having controls in both the front and rear of the trains. Locomotives will be at the outbound end of the push-pull trains. Coaches will be pushed into Chicago and pulled back to the suburbs on North Western's three suburban lines.

Cab-equipped cars will seat 155 passengers. Trailers, or intermediate coaches, will seat 161. When the 116 new cars are in operation, the C&NW will have a completely modern 200-car fleet with a bigger seating capacity than the 415 old coaches they will replace.

All electric power for heating and air conditioning, lighting and other appliances will be transmitted via train lines from a power plant in the locomotive. Push-pull cars are about 10 tons lighter than conventional bi-level cars, largely because the new equipment isn't burdened with steam pipes and electric generators and other undercar "hardware".

The all-electric heating system operates on 480 volt, 60 cycle, 3 phase current from the alternator on the locomotive. Floor heat is provided by strip heaters along each side wall at the lower-level floor line. Overhead heat is provided by heat units in the main air conditioning ducts. With the outside temperature of 10 degrees below zero, the system will maintain

a minimum interior temperature of 60 F.

Air conditioning is provided by two 8-ton self-contained units in the ceiling at the center vestibule (each unit supplies half the car). Unit capacity is rated at 96,000 Btu/hr with a total air supply of 2,400 cfm, 25 percent outside air, based on outside temperature of 100 F., 50 percent relative humidity. The duct system consists of one duct on each side of the car, built into the upper-level floors; and a single center line ceiling duct.

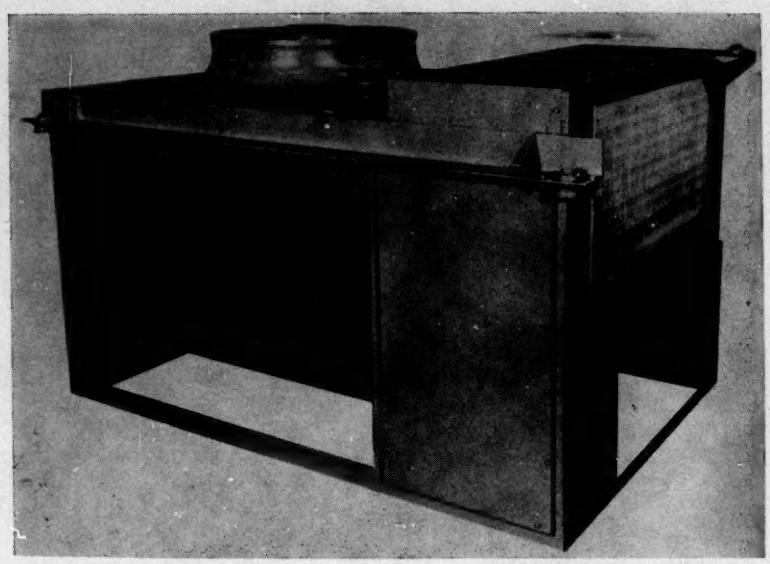
All major components are of Trane manufacture, who has been awarded the air conditioning contract for the 232 units. The self-contained unit to be used in the new commuter cars is the same type as the original 26 Trane developed for C&NW bi-level intercity cars in 1958.

Each unit contains a 3-cylinder accessible hermetic industrial type compressor, split coil evaporator and fan, condenser coil and fan and a motor starter panel.

Each cooling unit contains an evaporator coil which is split into two equal sections—one upper and one lower section. To control refrigerant flow, each section is provided with a thermostatic expansion and solenoid liquid valve.

The thermostatic expansion valve acts as a metering device to control the amount of liquid refrigerant that enters the coil. The liquid solenoid valve is an electrically controlled shutoff valve. When energized, it opens to permit liquid refrigerant to flow through the expansion valve and then into the coil section.

Each solenoid liquid valve is controlled by an individual relay which is, in turn, controlled by a two-step thermostat. As car temperature increases (above 79°), the first stage of the two-stage thermostat will close. This action energizes the first relay and opens the solenoid liquid valve on the upper section of the split coil. Liquid refrigerant will then flow through the coil and cooling will take place. If car temperature continues to increase (above 81°), the second stage of the thermostat will close, energize the second relay and open the solenoid valve on the lower coil section. In this manner, additional cooling capacity is obtained.



Two self-contained railway air conditioners, such as this, will be concealed at the center over the vestibule of each of the new C&NW commuter coaches. Each unit—which air conditions half a car, has a cooling capacity of 8-tons.

As the second relay closes, it will also energize the unloader solenoid valve on the compressor. This causes the second and third cylinders of the compressor to load, and the compressor operates at 100 percent capacity.

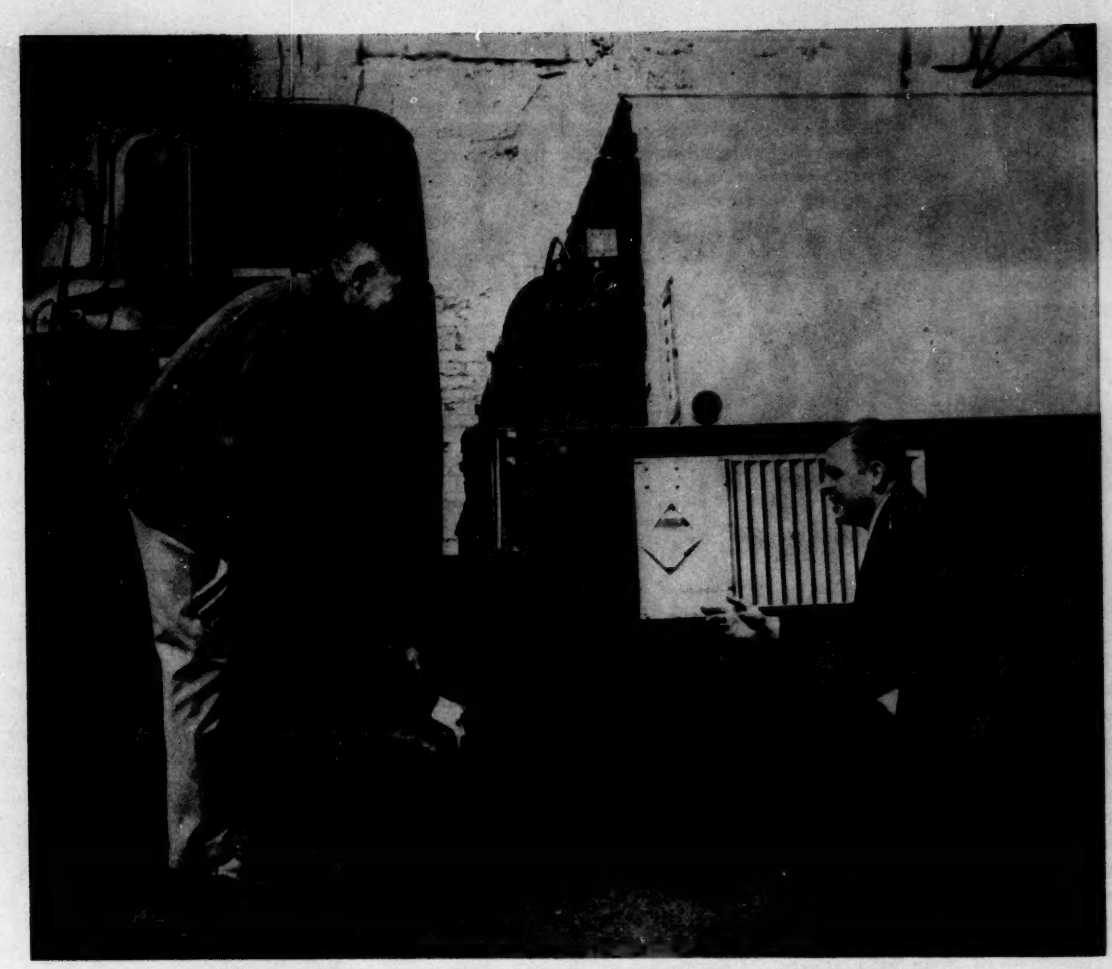
When car temperature is lowered (below 81°), the second stage of the thermostat will open. This de-energizes the second relay and closes the solenoid liquid valve on the lower coil section, shutting off the flow of refrigerant. A further decrease in car temperature (below 79°) causes the first stage of the thermostat to close (through its relay) the solenoid valve on the upper coil section. With both solenoid valves closed, liquid refrigerant cannot flow through the coil sections and cooling is discontinued.

Refrigerated Tank Truck

»» FISH in transit from hatchery to lakes and streams in the State of Oregon, demand and get a cool comfortable ride in refrigerated tank trucks. If they are not cooled during the ride, which may be as long as 12 hours, they die in great numbers.

The Oregon State Game Commission distributes about 20 million fish to the streams and lakes of the state each year. Total weight of the fish amounts to about 750,000 pounds and 24 tank units, including ten portable smaller tanks, are used to do the job. The standard tank has a capacity of 1,000 gallons, is of double wall steel construction and insulated with three inches of styrofoam. Water is constantly circulated by centrifugal pump and aerated by venturi aspirators. Hauls up to 12 hours duration may be necessary and maximum ambient air temperatures encountered are about 100°F.

Fish hauled in water temperatures above 50°F will suffer losses termed "delayed mortality" which occurs several days after the fish are released in their new environment. Mortality averages about 15 percent but may run as high as 50 percent. The primary reason for



Pictured is one of the refrigerated tank trucks used by the Oregon State Game Commission to transport fish from hatchery to lakes. Reino Koski, left, is in charge of fish liberation. Driver of the truck Bob Ramsey is shown center. Bill Harris, right, is the designing engineer of the refrigerating job.

Transports Live Fish

such mortality is still undiscovered but hauling temperatures of 40°F to 45°F will prevent it.

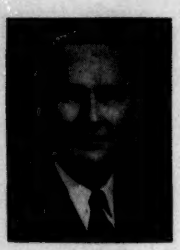
During the past year several of the tank trucks were equipped with refrigerating machines to cool the water in which the fish are held. These refrigerating machines installed by Harris Ice Machine Works of Portland, Oregon, are truck engine driven through a flexible shaft and operate as long as the truck motor is operated. The machines are also equipped with standby electric motor drives which can be plugged into an electric outlet to run the refrigeration compressor when the truck engine is not in operation.

The refrigerating system has its own electric generating plant to run the condenser fan thus eliminating this load on the truck engine battery. With this type of equipment overnight stops with a load of fish is permissible.

Performance of the refrigerated tankers under normal daily routine has been very satisfactory and it would appear that the water temperature problems of the Commission are solved. Long hauls in 90 degree weather have been made and water temperatures have held steady at 41°F. As a result "delayed mortality" has been eliminated and the commission has found that it is possible to increase the capacity of the tankers because of the lower water temperatures. Formerly the tanks were loaded at a density of one pound of fish per gallon of water. Since refrigerating the trucks they have increased the density about 50 percent and are hopeful that after further tests it will be possible to haul fish at a density of two pounds per gallon which will greatly decrease the stocking costs.

F. W. Badger
Asst. Chief Engineer

This is the second of a two-part article presenting a study in the causes of failures to air conditioning equipment. This concluding installment deals with the preventive maintenance program during the period that comfort air conditioning is required.



J. F. Martin
Asst. Chief Engineer

Preventive Maintenance For Central Air Conditioning Systems

»» THE start-up procedure for a central air conditioning system depends principally on, first, last fall's shutdown routine and, secondly, on how efficiently the various parts were serviced during the idle period. If the components that required dismantling or repairs are given a "test run" prior to start-up, then that procedure is materially simplified. Careful planning is essential in order that neglect of some part of the system will not cause operating difficulty later in the season. The operating instructions for the various components should be carefully followed.

Before the refrigerating vessels and machinery are placed in service an inspection of related equipment is in order. The air handling units should be examined for clean filters, properly adjusted dampers and clean duct work. Heat transfer coils should be flushed out. Chillers, condensers and other exchangers having water spaces which were drained at time of lay-up should be flushed out, head bolts tightened, attached pipe connections checked, strainers cleaned and the piping between the various units inspected *before* the valves in the chilled and cooling water lines are opened.

Depending on the system, cooling towers, evaporative condensers and attached piping should be examined. Spray nozzles, eliminators, float valve mechanisms and controls should be in good order.

Before any electric motor that has been idle for any appreciable time is started, the insulation resistance to ground of the windings should be checked with an ohmmeter. The insulation resistance to ground should be at least 1 megohm per 100 rated nameplate volts, and in no case less than 1 megohm.

An adequate flow of cooling water should be assured before the compressors are started. Immediately after returning the charge to a chlorinated hydrocarbon refrigerant cicuit a careful check for leaks should be made using a halide detector. The various controls, instruments and automatic valves should be checked for accuracy, calibration and response.

For at least the first two hours after the system has been returned to service the various components should be checked constantly for any overheating, overloading, increase in vibration, unusual noises or other evidence of distress.

Control and Safety Devices

No central air conditioning system can be operated properly and efficiently if its controls are faulty or incorrectly adjusted. No system is safe to operate if its safety devices are not in satisfactory working order. In spite of these self-evident facts a number of failures included in the study were traced directly to control or safety devices being in improper operating condition.

In order for the operators to recognize any malfunctioning of the system, and thus, immediately take the necessary corrective action, it is imperative that they be thoroughly trained in the purposes and functions of the control and safety devices. Operators should, in addition, have available for their ready reference the manufacturers' operating and service manuals. Allow only fully qualified persons to adjust control or safety devices, and maintain a rigidly monitored system of periodic checks of such equipment to assure that it is kept in proper working order at all times! It is too late to find that a low temperature cut-out had not been in working condition after a chiller has been seriously damaged from freezing.

Adjustment and maintenance of expansion valves, evaporator pressure regulators and like controls are greatly simplified, usually at comparatively small cost, by providing shut-off valves on either side of such controls together with a valved by-pass line. This permits adjustment, and in most cases even replacement, of defective controls without shutdown, and also, decreases the possibility of moisture-laden air entering the refrigerant circuit.

Inadequate Lubrication

More than sixty-five percent of over nine hundred failures of motor, reciprocating compressor, centrifugal pump and fan bearings were found to be directly caused by indadequate lubrication. "Inadequate lubrication" is defined not only as insufficient lubrication, but also as the use of unsuitable lubricants. Unsuitable lubricants are those which are contaminated, or of an inferior quality, or of an im-

proper type for the particular application. Thus, it is important to use only lubricants that are recommended by either the manufacturer of the equipment or by a reputable consultant. Since a reasonable amount of maintenance will prevent failures resulting from improper lubrication, it is believed that failures from this cause should be classed as preventable.

When motors, centrifugal pumps and fans are shipped from the factory, any ball bearings requiring periodic lubrication are generally packed with sufficient grease to last for a limited time; however, it is considered good practice to add a small amount of grease soon after the unit is put in operation, and thereafter at suitable intervals. In general, the bearing housing should be kept from one-third to one-half full with shaft sizes up to three inches in diameter; and from one-half to three-fourths full in the larger shaft sizes. It is well to remember that excessive lubrication can cause failures of ball bearings, just as lack of lubrication causes failures of all types of bearings. In addition, careless lubrication can result in deterioration of the insulation of motor windings from oil or grease leakage.

Manufacturers of reciprocating compressors will advise upon request as to the type of oil best suited to the compressor. Even when an oil has all the desired characteristics, sludging may be caused by the presence of water. Moisture enters the system with air whenever the compressor is opened for inspection or repair, or when air leaks through an external lubricator. Being hygroscopic, the chlorinated hydrocarbon refrigerants may retain some moisture even after attempts to purge the system of air. A small amount of lubricating oil is always circulated through the system with the refrigerant and will be emulsified upon contact with moisture. This will impair the lubricating qualities of the oil, and cause the formation of sludge. If a proper oil is being used and sludging occurs, the presence of moisture should be suspected, and necessary corrective measures taken promptly. This may even entail pumping out the system and recharging.

ROTATING EQUIPMENT

Listing only the initial parts involved in the majority of the failures and the principal direct causes of failure.

Failures		Direct Causes of Failure	
MOTORS (3488 Analyzed)		***MOTOR WINDINGS***	
Initial Part	*Number*	*Cause*	*Number*
Windings	2465	Moisture	524
Bearings	550	Deterioration of Insulation	425
		Line Surges (Lightning, etc.)	341
COMPRESSORS (1246 Analyzed)		Foreign Material (Dirt, grease, etc.)	193
		Overloading	160
Valves	427	Failure to Maintain Control or Protective Devices	75
Bearings	293	***MOTOR BEARINGS***	
Shafts	102	Inadequate Lubrication	346
Connecting Rods	17	Excessive Belt Tension	61
Pistons	84	***COMPRESSORS***	
Piston Rings	21	Metal Fatigue (Progressive crack)	546
Cylinders	67	Inadequate Lubrication	277
Cylinder Heads	15	Liquid in Cylinders	172
Fastening Devices	85	Misalignment	35
		Improper Adjustment	28
CENTRIFUGAL PUMPS (114 Analyzed)		Improper Operation	23
		CENTRIFUGAL PUMPS	
Shafts	46	Metal Fatigue (Progressive crack)	28
Bearings	27	Inadequate Lubrication	20
Impellers	17	Foreign Object entering Casing	11
Casings	6	Misalignment	10
		Loosening of Fastening or Locking Devices	6
FANS (95 Analyzed)		***FANS***	
		Metal Fatigue (Progressive crack)	26
Blades	43	Inadequate Lubrication	24
Bearings	39	Excessive Vibration	9
		Loosening of Fastening or Locking Devices	8

Insufficient lubrication of the bearings of reciprocating compressors may be the result of one or more conditions: excessive bearing clearances or worn bearings; defective or worn oil pumps or rings; low oil level in the crankcase; dirty or sludged lubricating oil causing jamming of rings or plugging of piping; excessive amounts of liquid refrigerant in the crankcase causing priming and foaming. The latter condition can also cause excessive amounts of oil to be carried over into the system.

The oil in the crankcase of a new compressor should be changed after the first week of operation, again after about two months of operation, and thereafter as necessary—but at least once a year. Some manufacturers recommend that the oil in modern, high-speed machines be changed every two or three months. The manufacturer's recommendations should be carefully followed. The filters and strainers should be cleaned whenever the oil is changed, and at intervals of from three to four months; oftener, if necessary.

Permitting a compressor to operate with excessively worn bearings is dangerous. Even a momentary stoppage or reduction in the supply of oil which might not seriously affect a good bearing, may cause a worn bearing to burn out. Such burnouts often cause scoring of bearing journals, and may require that the shaft or pin be replaced, or, at the very least, that the compressor be taken out of service when most needed. Excessive clearances caused by serious wear at one bearing can cause large oil-pressure drops across that bearing, and may result in burn-outs of other bearings. The misalignment initiated by seriously worn bearings frequently results in metal fatigue and subsequent breaking of the shaft, pins or connecting rods.

All bearings in a reciprocating compressor should be *thoroughly* inspected for damage after encountering any lubricating oil difficulty. In addition, they should be inspected and cleaned every time the oil is changed. It should be remembered that a bearing is a wearing part and will not operate

for extended periods without inspection and attention.

Another common cause of an insufficient supply of oil to compressor bearings is defective oil pumps, usually the result of wearing of either a pump bearing or of the pump itself. Worn pump bearings can cause misalignment of the pump parts to such a degree that oil cannot be pumped in either sufficient quantity or pressure. The wear of pump parts other than bearings also results in reduced oil flow and pressure. Therefore, it is evident that oil pumps should be inspected whenever possible. Certainly, each time the compressor bearings are checked.

A good method of preventing damage from low oil pressure, whether caused by a defective oil pump, worn bearings or clogged oil lines, is to install a cut-out to shut down the compressor in the event that the oil pressure drops below a pre-determined minimum. The cut-out should be activated by the oil pressure at the main bearing located most distant from the oil pump discharge. Such devices are desirable on all compressors equiped with pressure oiling systems; especially, those that are unattended or that are checked only at intervals, as low oil pressure can cause serious damage in a matter of minutes.

Before any check is made to determine the true operating oil level in the compressor, the machine should be operated for at least twenty minutes, since there is always a small amount of lubricating oil circulated with the refrigerant. The oil level should then be at the point on the sight glass or gage, specified by the manufacturer as the normal operating level.

It should be noted that too high an oil level can result in an excessive amount of oil being circulated with the refrigerant. This condition will materially reduce efficiencies of the condenser and the evaporator by coating internal surfaces with oil which in effect insulates and retards heat-exchange.

Loading and Related Factors

Failures of motor windings due to continuous overloads can be eliminated by taking care that nameplate current values are not exceeded. It must be kept in mind that the heating effect varies as the square of the current; hence, even small increases in ampere loads mean relatively large increases in heating which may cause rapid deterioration of the insulation. Laboratory tests have shown that the normal life of Class A insulation may be halved by a rise in operating temperature of eight to ten degrees C.

It has been determined that rotors of motors driving refrigerating compressors and air conditioning units are near the top of the list in the number of failures produced.

Failures of rotor bars and end rings of squirrel cage motors were generally found to have been caused by continuous overloads, starting loads which had been continued beyond the starting time for which the motor was designed, frequent starts resulting in an accumulation of heat in certain parts having a limited dissipating capacity, and excessive vibration.

The heat from continuous overloads generally causes stator windings to fail before the rotor is seriously damaged. Intermittent overloads, which result in overheating and cooling, set up stresses in the bars and end rings. These stresses, combined with sudden shock loads or vibration, may cause the bars and rings to develop small cracks which can eventually lead to failure. The breaking of the bars or end rings may damage only the rotor if the condition is promptly found and properly corrected. But if operation is continued, the broken parts may be thrown outward by centrifugal force causing severe damage to the stator windings and even to the stator laminations.

The high inertia of the driven object may cause overloads during starting periods. While normal operating speed may not require much power, bringing the rotating parts up to speed may require considerable power. During the starting period, the rotor-slip (the speed of the magnetic field rotating in the stator minus the actual speed of the rotor) is great, and therefore, excessive current flows in the rotor bars and end rings. If this slip and subsequent overheating continues for longer than the starting period for which the motor is designed, a failure may result. Thus, obviously frequent starts without interim cooling periods may also cause overheating and failure.

Fortunately, many rotor troubles reveal some symptoms in the early stages before serious troubles occur. Sluggish starts, for instance, in which the motor takes more than normal time in coming up to speed may indicate partial cracking of bars or end rings, as such cracks cause high resistance in the rotor electrical circuits. Another early symptom is unusual vibration. This may indicate unbalanced rotor conditions due to broken or cracked bars or end rings.

One of the best methods for locating squirrel cage rotor winding troubles is to accurately measure the motor r.p.m. by the use of a speed counter and a watch—taking the revolutions for several minutes in order to obtain a true reading. Should the results indicate that the speed is below the normal full load nameplate rating, while the ampere load, operating temperature, rated voltage and frequency are found to be normal, rotor trouble should be suspected. The motor should be disassembled for a careful inspection.

The majority of the failures of the rotors of wound rotor motors occurred to the coil end connections, with the causes of failures (comparable to the causes of failures of the bars and end rings comprising the rotor windings of the squirrel cage motors) due principally to continuous overloads, high-inertia starting loads and frequent starts. If coil end connections which are often soldered, had not been properly cleaned and well tinned during fabrication, the relatively high resistance may cause local heating at these points and the solder will soften until the connection finally fails. Often just prior to the failure, sluggishness during starting periods will be evident. At that time a prompt inspection of the rotor windings (as suggested in the first part of this article) may prevent a serious failure.

Many synchronous motors are designed for unity power factor operation. Consequently the field coils do not have enough capacity to carry the excitation current re-

quired for the degree of power factor correction which may be essential in some cases. The result of overexcitation of the field winding of such a motor is, of course, to roast out the field winding.

Unfortunately, the nameplates of some of the older synchronous motors do not carry the field current rating. Thus, the operators are in some cases unknowingly overexciting the fields. The nameplates on practically all of the present day synchronous motors carry the field current rating so there is no justification for overexcitation. In all cases where the rated field current is not known the manufacturer should be requested to supply the maximum field current value.

Periodic analyses have shown that approximately eighty percent of all failures of amortisseur windings are caused either by loss of excitation or by improper operation (too frequent starts, jogging or overloading). In either instance the winding was being abused.

An amortisseur winding is designed to function as a squirrel cage rotor winding in starting a synchronous motor as an induction motor. It does not have the thermal capacity to absorb nor the radiation surface sufficient to dissipate the heat generated in it when loss of excitation or improper operation results in a synchronous motor continuing to operate as an induction motor.

Correct brush pressure is important in the proper functioning of wound rotor and synchronous motors. Of equal importance is the material of which the brush is made. It must be neither so soft that it wears away too rapidly nor so hard that it excessively wears or scores the collector ring.

Care should be taken to see that open-type motors are properly protected where there is danger that foreign objects may enter the motor frame openings.

Excessive Vibration

The survey disclosed that the most frequent direct cause for failures of refrigerant piping and other pressure vessel components was excessive vibration. Thus, the importance of controlling vibration can not be overemphasized. Any sudden increase in vibration of any part of the system is sufficient reason for prompt investigation and corrective action.

Small diameter copper control and instrument lines attached to compressors, pumps, and larger piping are especially susceptible to damage from vibration. The focal point of such failures is often at the flared connections. A study of many cases revealed that careless workmanship left grooves around the flared tubing setting up "stress raisers" which, together with the brittleness inherent in work-hardened copper accelerated by excessive vibration, resulted in fatigue cracking. Although periodic examination and annealing of these flared ends would undoubtedly prevent many failures, replacement of these small items on a regular schedule is usually more econom-

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IN ADDITION — Phillips pilot operated valves are available for all common refrigerants, down to —50° F. Operates with as low as 2 PSI pressure drop and up to 250 PSI with selected springs. Line sizes ½ inch to 4 inches with steel or copper connections.

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REMPE COMPANY

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ical. It is not the loss of the tubing that is of paramount concern but the expense of replacing lost refrigerant. In a recent case 2,500 lbs. of refrigerant were lost through a small crack in a one-half inch line!

Excessive vibration of piping is usually caused by internal pulsations of gas or fluid set up by the connected machinery. Thus, not only small diameter piping but also suction and discharge piping are affected.

There are many flexible connectors, absorbers and dampeners on the market that will provide suitable protection against the effects of vibration. The suppliers of such devices should be consulted and their recommendations carefully followed as these devices are usually designed for a specific application. Excessive vibration cannot be reduced by anchoring pipe in a loose and flimsy manner.

While other forces such as the dead weight of the pipe and its contents, expansion and contraction can contribute to failures, the most frequent failure producer by far has been vibration. Very often during the elimination of vibration these other conditions can conveniently be corrected.

Vibration was also a contributing factor in many of the failures involving motors, reciprocating compressors, centrifugal pumps and fans. While the possible causes for excessive vibration of the machinery components are numerous, and they can be complex, the correction of this failure-producing condition is usually a relatively simple matter.

Line Surges

The most common causes of overvoltage are lightning, physical contact with a high voltage circuit, resonance effects in series inductive-capacitive circuits, intermittent grounds and switching surges.

A record of failures of electrical equipment caused by lightning has been maintained by the Hartford Steam Boiler for many years and it is encouraging to note that considerable progress has been made in the elimination of failures from this cause. However, such failures still account for a substantial percentage of the total in those areas susceptible to this type of failure, so there is room for further improvement.

It is generally conceded that each installation must be engineered individually for proper lightning protection. The larger manufacturers today have specialists who have made detailed studies of the problems involved in lessening failures from this cause. They have found there is no "cure-all" which can be applied generally, but that a careful study of conditions existing at the location must be made. Wherever troubles have been experienced by lightning it is well to call in such a specialist and after suitable protective equipment has once been installed at their direction, recommended maintenance should be followed.

In spite of apparently good protective equipment, lightning frequently causes severe damage if the arrester ground resistance is high. Experience has proven that such ground resistance does not remain constant. A test should be made at least once a year. A resistance to ground of five ohms or less is highly desirable.

Liquid in Cylinders

The major direct cause of valve trouble, other than fatigue, was found to be the return of liquid refrigerant to the compressor with consequent "slugging" of the valves. While most compressors will handle a little "wet" gas without too much difficulty, they are designed to be gas compressors and cannot be expected to pump liquid refrigerant without incurring breakage of valves and other parts. The return of liquid refrigerant requires that a valve, which may have already been somewhat fatigued by millions of stress reversals and by previous small amounts of liquid refrigerant, suddenly handle a practically incompressible fluid. The safety heads are designed to lift and give a greater escape area for any liquid refrigerant entering the cylinder. In most cases they will prevent the destruction of the cylinder and piston, but often, do not lift quickly enough to save the valves.

The conditions which most frequently resulted in the "slugging" of a compressor with liquid refrigerant were improper starting (es-

pecially when a pump-down cycle was not provided and after a long shutdown) and the use of expansion or float valves which were of improper size or adjustment. Most manufacturers provide instructions for starting and operating their compressors. These should be followed carefully.

Metal Fatigue—Progressive Cracking

Actually, a progressive crack or fatigue failure due to inadequate maintenance is the result of a cause such as excessive wear of parts, misalignment, improper adjustment or fit of parts. Consequently, had complete information been available on every failure there would have been no need for such a designation in this particular study. However, due to the frequent need of repairing a machine and returning it to service as soon as possible, there is sometimes no opportunity for making a complete investigation. While it is almost always possible to determine from examination of a broken part whether or not the break occurred as a result of fatigue or progressive crack, it is very difficult, and often impossible, to determine the actual cause of the failure unless an examination of the machine can be made before repairs are started, or unless the damaged parts indicate a design weakness or material defect. This accounts for the relatively high number of failures classified in this group.

Moisture in the refrigerant circuit at low temperatures may freeze in the expansion valve orifices, or plug the fine screens in the strainer. Any time it is necessary to open a refrigerant line, entering air will add to the contaminating moisture in the system unless a suitable dehydrator or drier is used. As a drier offers some resistance in the liquid line, limited use of the device is usually desired. To facilitate recharging of the drier and operation of the system without its use it is suggested that the drier be installed with a bypass and isolating shut-off valves.

The results of the study on which this article is based stress the fact that preventive maintenance is the best tool in reducing failures. However, merely knowing the causes of failures in equipment will be of little value unless this knowledge is put into effect. The safe operation and continuity of service of central air conditioning systems rests mainly on the day-to-day efforts of the operators and service personnel.

Cyclomatic continued from page 15.

tractive as it conserves working capital and pegs the per unit cost at a figure below that of any other hardening method with all costs considered. Their reduced rate per unit for all units processed in excess of the annual minimum provides an incentive to process as much product through the machine as possible to reduce the overall average cost per unit.

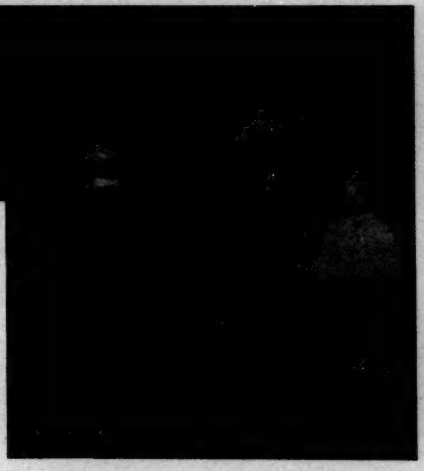
Lease Arrangements

The model installed at Costa is available on a five-year lease at a yearly minimum of $15,000 based on $.003 per pound of product hardened for the first 5,000,000 pounds and $.0015 per pound for any additional volume within each year. Cyclomatic will assist in preparing the layout for tying-in any conveyors that may be needed, the power and refrigeration lines and any packaging or wrapping equipment that may be desired.

Businessmen are said to prefer to lease for the following reasons:

1. Leasing offers virtually 100 percent financing as opposed to 75 percent or 80 percent through other methods.
2. The normal bank line of credit is not affected.
3. Working capital is preserved.
4. The right to use the equipment is paid for out of before-tax earnings rather than after-tax profits.
5. Cost cutting equipment required to compete can be installed when needed.
6. Long-term financing is obtained without dilution of ownership or control.

THE ULTIMATE IN THE COMPRESSION REFRIGERATION CYCLE*



THIS IS ANOTHER CYCLE CENTER, factory assembled and on its way to a 150 ton poultry freezing plant.

What will it do?*

It will provide liquid overfeed to the evaporators, catch the excess liquid and recirculate it to the evaporators, with these results:

- FULL COMPRESSOR PROTECTION AGAINST SLUGS
- PEAK COIL AND COMPRESSOR EFFICIENCIES
- SUB COOLED LIQUID FEED AT CONSTANT PRESSURE THE YEAR AROUND
- PRACTICALLY UNLIMITED RATE OF LIQUID FEED AT ABSOLUTELY NO POWER COST
- NO MECHANICAL PUMPS
- NO FLASH GAS IN LIQUID LINES
- SAFE, AUTOMATIC PLANT OPERATION
- OIL SEPARATION, ANY REFRIGERANT
- HIGHER SUCTION PRESSURES
- LARGE POWER SAVINGS
- LARGE SAVINGS IN FIRST COST ON NEW PLANTS. FOR EXAMPLE, THE RECEIVER IS NOT REQUIRED AND SURGE DRUMS ARE ELIMINATED.
- AUTOMATIC HOT GAS DEFROSTING AT MINIMUM COST

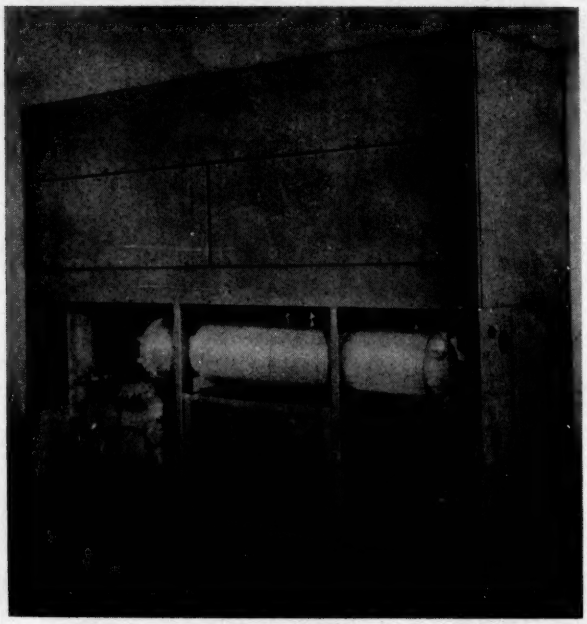
ASK FOR BULLETIN CC-2

* NOT JUST A LIQUID RETURN UNIT. Available for any refrigerant, in capacities from 10 to 1,000 tons and more. Factory assembly is optional.

J. E. Watkins Co.

New Products Designed to Improve Operation

Packaged Multi-Zone Air Conditioners



A LINE of ruggedly designed packaged multi-zone air conditioners is now available from American-Standard Industrial Division, Detroit 32, Michigan.

The new equipment is available in nominal 25-ton, 30-ton and 40-ton sizes. Nominal air handling capacities are 10,200 cfm, 12,600 cfm and 17,100 cfm, respectively. In these sizes and capacities, they can provide comfort conditioning for large open areas or can serve several zones or rooms or any area where excessive heat load presents a special problem. Quiet operation makes the new units well suited to the combination heating-cooling requirements of medical clinics, churches and one-story or two-story office buildings.

The new American-Standard line can be purchased as either a single-zone basic unit or as a multi-zone unit. The single-zone unit is available with top horizontal or up-blast discharge. It may be equipped with a steam or hot water heating coil for off-season or winter heating. It is available in either of two arrangements.

The multi-zone unit is also available with top horizontal or up-blast discharge. This design features a "hot-deck assembly", in which the heating coil is mounted, in either of two arrangements.

Asphalt Crack Filler

A RUBBER asphalt joint sealer and crack filler has been developed by the United States Chemical Company, Inc., of Lincoln, Nebraska. The product, called Join Seal, is now in production.

Join Seal offers a fast, economical way to seal out moisture, drafts, insects and dust. It bonds well to concrete, steel, masonry and other surfaces and remains flexible over a long period of time. Because it blends rubber and asphalt, it has a flexible quality which makes it possible for it to stretch as joints expand, and to withstand moisture. This flexibility will make it last many seasons longer than materials which have a tendency to shrink and harden with age.

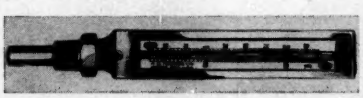
The maintenance department of a large midwestern university recently put this product to a severe weather test. They dropped the temperature on a test use to 20 degrees below zero and then raised it to 100 degrees above. Join Seal retained its flexibility, size and clinging power throughout the test.

This sealer is sold in a standard tube which fits ordinary caulking guns and has a tip which can be cut to desired width of application. The color is black. By using aluminum paint first, it can be painted over in any desired color.

Among the many uses which have been favorably reported are: Sealing foundation cracks, sealing around pipes which run through walls, filling cracks in driveways, sealing metal buildings, repairing roofs, gutters and roof parts—and many others.

Economy Thermometer

A LINE of low-cost, precision thermometers which accurately measure temperatures of hot and cold water lines, heater coils and similar processing and refinery equipment, has been announced by the H. O. Trerice Company, Detroit.



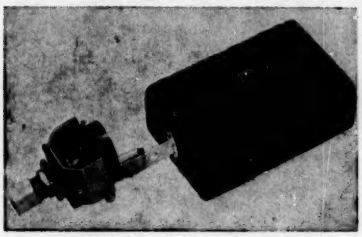
These new economy thermometers are designed for use on refrigeration systems, hot water tanks and generators, oil burner pre-heating coils and other commercial and industrial circulating and storage systems requiring careful temperature maintenance. 1/2" npt brass separable sockets are provided for easy installation and unit replacement, and a 2" brass extension neck socket is offered for insulated lines. Thermometer cases are

available in straight, regular angle, or oblique form.

The new line sells for one-third the price of most standard industrial thermometers, and according to the manufacturer, provides contractors and specifying engineers with an economical, precision instrument for thermal indication.

Adjustable Valve

A NEW type of float valve has been developed by the Skuttle Manufacturing Company, Milford, Michigan. The valve operates on a single pivot principle for trouble-free use.



Called the A-1106-9, the new valve is simplified to the point that there are no moving parts. The all rubber valve seat is adjustable and can be reversed. The unique design of the valve seat enables it to act as a splash shield, and is easily replaced. Another feature is the chrome plated valve jet that assures positive shut-off.

The manufacturer states that this valve and foam glass float assembly is ideal for use with evaporative coolers, ice making machines, water feeders, and other automatic control applications.

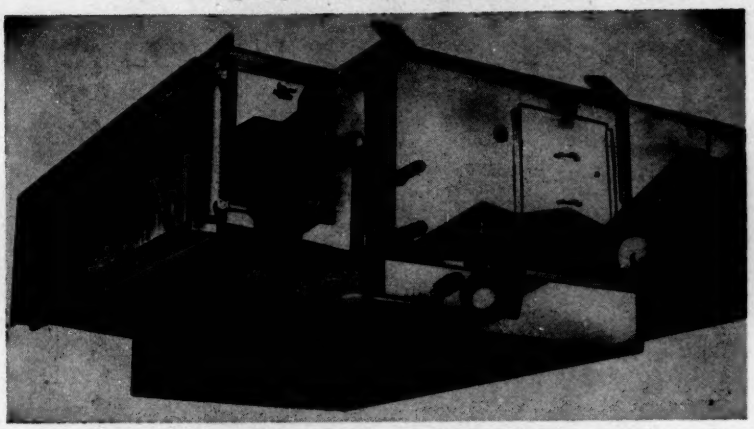
Metal Carrying Case

MADDEN Brass Products Co., Aurora, Illinois, has announced production of a new metal carrying case for carrying charging and testing units. The new case protects units from damage when not in use or when being carried from one place to another.

It features a compartment for accessory fittings, a carrying handle, and a safety latch for a small padlock.

Complete unit includes the sturdy new metal case, gauges, manifold bar with handwheels, handy hanging hook, handy hose holder, and one set of Madden color coded charging lines.

Sprayed Coil Fan Unit



HOSPITALS, public and commercial buildings, precision manufacturing operations, and many more, are prospects for the newest addition to Drayer-Hanson's line-up of air conditioning products—their new "SCD", Sprayed Coil Humidity Control unit.

Where the need is to maintain close humidity control and achieve cleaner air, the answer is these versatile air handling combination units, says the West Coast manufacturer. The line is initially offered in 15 sizes each—horizontal or vertical models; with cfm range from 668 to 32,250. "SCD's" are available with preheat and reheat coils, if required.

Models closely follow construction and performance characteristics of Drayer's central station air-handling units. Modular construction; arrangements for every application; removable panels; independent structural steel frame, are cited as key sales factors.

Coil section of "SCD" Series has space for 10 row coils—to cool and reheat. Highlight of spray section is an integrally-mounted pump. For automatic water make-up, an automatic float valve is used.

To facilitate maintenance, the manufacturer has provided big access doors at convenient points on the equipment. Water sprays on "SCD" models, during heating season, will humidify the air when passing through moistened coils.

Vacuum Refrigerated Centrifuge

THE first centrifuge ever made to spin a capacity of 1500 ml. (6 x 250 ml.) at 60,000 x G and 3,300 ml. (6 x 550 at 33,000 x G). In addition, this new vacuum-type, refrigerated centrifuge interchangeably accommodates and spins smaller rotors with 400 ml. (8 x 50 ml.) and 360 ml. (24 x 15 ml.) at forces up to 51,000 x G.

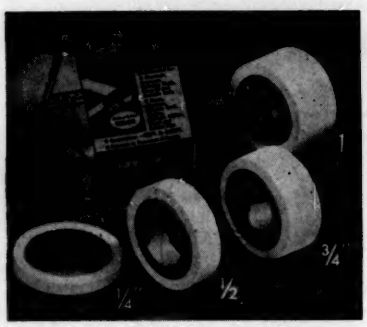
Referred to as the Lourdes Vacu-Fuge, the Model VA-2 features automatic rotor acceleration for fully adjustable low to high speed operation. Electro-dynamic braking provides fast rotor deceleration without strain on moving parts, and an automatic time-relay permits the rotor to coast to a smooth stop without disturbance of the sediment.

New Products cont.

The new, patented refrigeration design permits operation of the rotor with temperatures as low as -10°C during extended high speed runs or, at -20°C during shorter runs or at lesser speeds. Rotors may be quickly precooled in the model VA-2 Vacu-Fuge. When operating under a vacuum, material temperatures can be maintained within 1°C for temperatures as low as -10°C.

Thred-Tape Pipe Joint Sealer

THRED-TAPE Pipe Joint Sealer is now offered by Crane Packing Co., in 4 convenient widths—1/4", 1/2", 3/4" and 1"—permitting selection of the size best suited to the joint to be sealed. This is in answer to the need for various widths due to the extreme range of pipe sizes used throughout industry. For example, it is generally recommended that Thred-Tape be used as follows: 1/4" width for pipe to 1/2", 1/2" width for pipe from 1/2" to 2", 3/4" width for pipe from 2" to 4" and 1" width for pipe 4" and over.

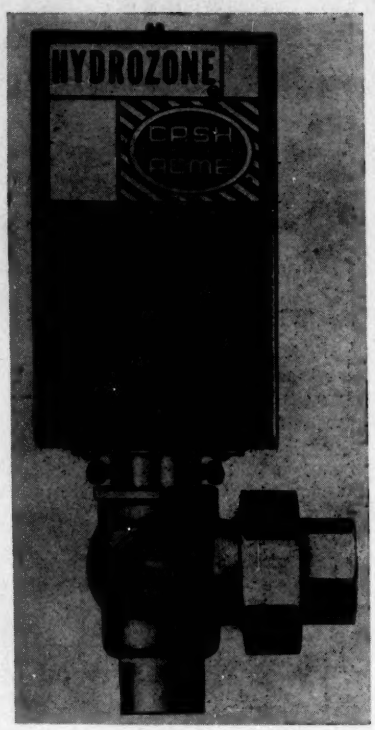


Made of chemically-inert DuPont Teflon, Thred-Tape has proved especially effective for handling the most destructive acids, caustics, corrosives, biologicals, toxics and gases. It withstands thousands of pounds of pressure, temperatures from -250° to +500°F. and can be used on all types of piping.

To seal the joint, Thred-Tape is merely wrapped around the male threads. The connection is then made in the usual fashion. The tape fills all voids to provide a leak-proof seal. Because of the lubricating characteristic of Teflon, joints can be drawn up to maximum tightness. Thred-Tape remains permanently plastic, permitting easy disassembly of connections even after years of service.

Motorized Zone Control

CASH-ACME announces a new motorized zone control valve for use on hydronic cooling systems.

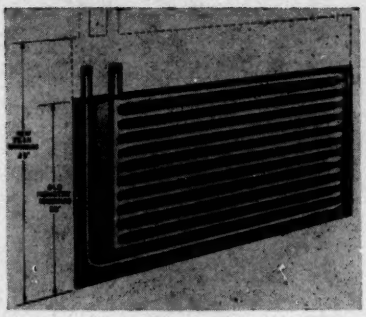


Designated the Hydrozone motorized valve, the valve features four body types for varying job conditions. Valve has a visual valve stem indicator, and is easily set for manual operation in case of power failure. A special Viton "O" ring (patent pending) is used to eliminate leaking at valve stem. Valve has 100% shut-off feature, allowing it to be used on low pressure systems. Angle body pattern allows flow through valve in any direction.

Dean Panelcoil Now Available

DEAN Products, Inc., 1048 Dean St., Brooklyn 38, N. Y., now offers their Dean Panelcoil in five standard widths, ranging from 12" to 29" wide. All five standard widths can be made to exact length requirements up to 143".

New 29" Width is a full seven inches wider than the previous 22" industry maximum. This extra width makes it possible in many cases to reduce the actual number of Panelcoils required for a given heating or cooling job. Result—fewer fittings, less connecting pipe, and most important of all—less labor.



Panelcoil has proved a highly economical and superior replacement of both old-style pipe coil and integral jacketing. It has a lower initial installed cost, can be replaced quickly and easily when required, has a higher Btu transfer rate than pipe coil, weighs less and occupies less space in almost all applications.

Dean Panelcoil Technical Data Sheet Series 15 through 59 give the entire Panelcoil engineering story. A valuable addition to your heating and cooling reference file.

Tube For Refrigeration Applications

THE introduction of ACR, a new copper tube expressly for refrigeration and air conditioning applications, has been announced by Wolverine Tube, Division of Calumet & Hecla, Inc.

Wolverine ACR (Type L) is a cleaned and sealed tube available in 20-foot straight lengths in sizes ranging from 1/4 inch nominal o.d. to 4 inches inclusive, and is ready for use. It will be marketed on a national basis, through refrigeration and air-conditioning wholesalers.

Other features of this seamless tube include color coding with ACR markings indicating its primary use is for air-conditioning and refrigeration applications.

Another highlight in the announcement includes a change in pricing policy which allows the wholesalers to combine orders for 50-foot coils of refrigeration tube with ACR, type L, 20-foot straight lengths to obtain the best quantity discount, as long as the total net weight involved is 2,000 pounds or over.

Wolverine recently made another announcement to the effect that three new sizes of tube were to be added to their coiled refrigeration tube line to allow a greater range for the user. Included are sizes with outside diameters of 7/8", 1-1/8" and 1-3/8". Like the 20' straight lengths, these 50-foot coils also include the features of being cleaned and capped.

DU PONT ANNOUNCES...

New "Zephyr" Containers for "Freon" Designed for Your Convenience

- Built-in carrying handle
- Can be used upright or inverted
- Can be stacked
- New handwheel valve
- Lighter in weight
- New 50 lb. size

These new "Zephyr" containers can be used either upright or inverted without special blocks or stands. A permanent collar protects the valve and serves as a built-in carrying handle. These are the only refrigerant containers that can be stacked one on top of the other. They are shorter—lighter—easier to carry. A 50 lb. size is now practical. No wrenches are needed because these new containers also have a new type handwheel valve. They will stand upright in your truck.

"Freon-12" and "Freon-22"—the premium quality refrigerants—are now available in these new "Zephyr" containers in 25 and 50 lb. sizes from your *leading* air conditioning and refrigeration wholesalers. Place your order for "Zephyr" containers today.

Please turn page for another announcement

NEW TOP *and* VALVE

are being added for your convenience

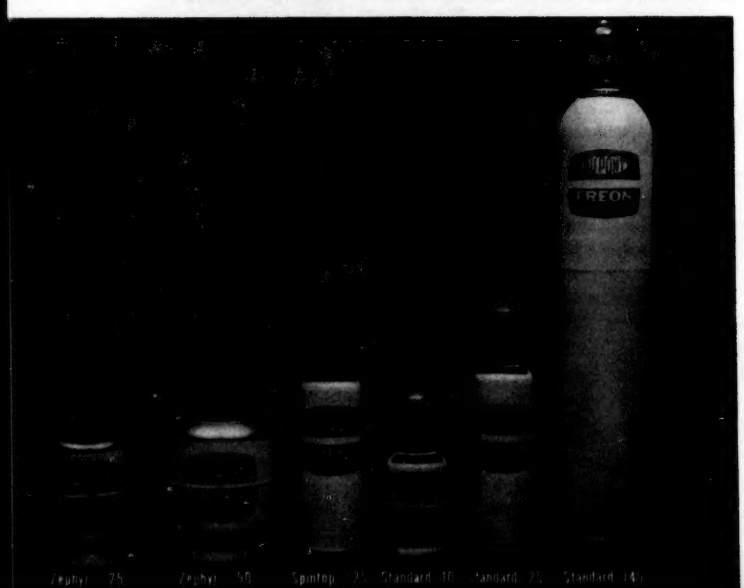
to Standard 25 lb. cylinders for "Freon"

This new "Spintop" cylinder is now available in addition to the Standard 25 lb. cylinder with hood cap. The "Spintop" is a convenient carrying handle, valve protector and stand. Being free to rotate, it provides easy access to the valve. The regular valve has been replaced with a convenient handwheel type that includes a special spring-loaded pressure relief device for added safety.

Now—a Container for Every Use

For your convenience "Freon" refrigerants are offered in a family of containers*. Each of these types of containers has its own distinctive advantages. The container that best suits your needs is available from your leading air conditioning and refrigeration wholesaler. Call him today for your order of "Freon" refrigerants.

**1 or 2 lb. "Can-O-Gas" containers of "Freon" refrigerants are available from the Virginia Smelting Co., our nationwide sales agent and authorized repackager.*



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refrigerants

DUPONT

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. . . through Chemistry

A-14864

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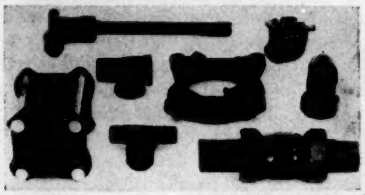
Epoxy Resin For Pipe Protection

A NEW epoxy resin pipe coating that can be applied more easily and quickly than conventional mill coatings, and at a competitive price, has been announced by Minnesota Mining and Manufacturing Co. (3M), St. Paul, Minnesota.



The one-part powder, called "Scotchkote" brand pipe protection resin No. 101, cures in less that 20 seconds with close coating tolerances. Solvent hazards and post-baking, normally associated with epoxies, are eliminated.

This new coating, for the first time, brings the physical and electrical properties of epoxies to the corrosion field at a price that will allow universal use.

Field experience has shown that the resin coated pipe can be handled in much the same manner as bare pipe, the manufacturer reports. In addition, welding of pipe sections can be accomplished through the resin coating, once an arc has been struck on a bared spot.

The resin upon application, is completely thermoset, and will not flow under pressure nor flow upon heating. It has an adhesion strength of 3,000 psi, and high impact strength which resists damage from soil or pipe movement, and the abrasion and shock of back-filling.

"Scotchkote" 101 resists attack by most chemicals, including hydrocarbons such as fuel oil, gasoline, kerosene and sweet or sour crude.

In salt crock tests, the resistance of the coating remained at a constantly high level for two-year periods of immersion under both anodic and cathodic conditions. A typical resistance value of a 10 mil coating is 10,000 megohms per square foot.

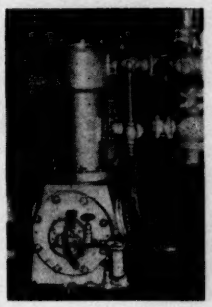
Mill application of the coating is a four-step process consisting of cleaning, heating, coating and jeeping the pipe. Laboratory models of resin coating equipment designed by 3M have shown that continuous application of the resin to irregularly shaped objects is economical and practical, with the use of portable, inexpensive equipment. The result of more than two years of development and testing, the epoxy resin is expected to have wide use in application on a variety of objects requiring corrosion protection. In addition to major use as a pipe protection coating, it can be applied to fittings, meter brackets, transformer cases, beams, supports and other related objects.

Utilities and pipe coating concerns, working with the resin on a pilot plant basis, have estimated that the cost of the resin-coated pipe "in the ground" will be competitive with conventional mill coatings. Savings are expected because of reduced shipping and handling damage, the ability to ship more pipe per carload, due to the thin (10 mil) coating, and the reduced amount of joint insulation material, as cutbacks on the ends are not usually required.

The resin is available to applicators, the manufacturer states. At the present time, several pipe coating companies have built pilot facilities and are supplying coated pipe. Initial emphasis has been placed on coating two inch and smaller pipe; however, pilot plant facilities are being expanded to handle larger diameter pipe.

HOWE Standard COMPRESSORS
For every size load and application—5 to 150 tons

HOWE-
VERSATILE
AS INDUSTRY
ITSELF!



HOWE Booster COMPRESSORS
For low temperature service

HOWE 3-Fan UNIT COOLERS
For heavy duty, high tonnage blast freezing, freezer storage

HOWE Polar Circle COILS
For freezer storage as well as normal temp work

AMMONIA & FREON RECEIVERS
also Shell and Tube Condensers, Oil Traps, Accumulators, Pressure Vessels

Throughout industry you'll find the versatility of HOWE refrigeration equipment doing a more efficient, more economical job. In meat packing, dairy product and ice making plants, warehouse storage, food processing and food freezing plants, and many others, HOWE Compressors and Components are doing may jobs with year-after-year dependability. Whatever your special needs—cooling, chilling, freezing, holding—there's a HOWE-engineered system to meet them.

For highest "Degree-Dollar" refrigeration efficiency at the lowest possible cost, consult HOWE today. More than 48 years of specialized experience backs our recommendations.

Write for literature.

Since 1912, manufacturers of compressors, condensers, accumulators, unit coolers, surge drums, vessels, fin and pipe coils, flake ice makers, receivers, etc.

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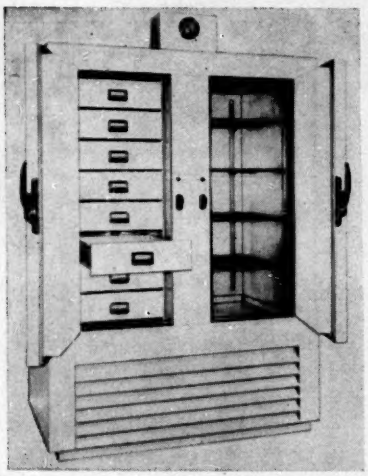
New Products cont.

15-Foot Biological

NOR-LAKE has added a 15-cubic-foot refrigerator to its commercial line. Designated R-15, this latest example has two locking doors behind which are eight adjustable plated wire shelves. This same refrigerator



—when equipped with drawers and an optional blood bank alarm system —becomes the DL-1500, and is especially suitable for safe storage of biologicals. A thermometer mounted atop the unit readily provides inside temperature readings, and is part of the alarm system. Eight file drawers, equipped with label holders, can be used on one side with wire shelves on the other. Or the entire storage space may be fitted with 16 drawers.

Featuring automatic condensate removal, the R-15 and DL-1500 have heater strips around both door openings. Dimensions are 60-13/16" high, 43-1/8" wide and 28-3/4" deep.

Winter Controls Air Cooled Condensers

RECOLD Corporation has announced a new "Wintermatic" control system which is now available for use with Recold Dri-Con Air Cooled condensers. The system is designed to regulate system head pressures during low ambient periods, preventing pressure from dropping below any desired minimum head pressure.

Basically, the system consists of two valves, an adjustable control valve and a balancing valve. The adjustable control acts as a pilot for the system and may be adjusted to maintain the minimum desired head pressure. As the pressure drops below this minimum, the Recold balancing valve opens and gas will bypass the air-cooled condensers, still maintaining the higher head pressure necessary to keep the compressor operating.

"Wintermatic" controls may be installed anywhere in the system, allowing flexibility of installation. They may be located near the compressor or receiver, in machine rooms, or at the condenser, if desired. No additional loops or traps other than normal are required in the piping. "Wintermatic" control valves are especially desirable for multiple circuiting, as each circuit may have its own, individual control.

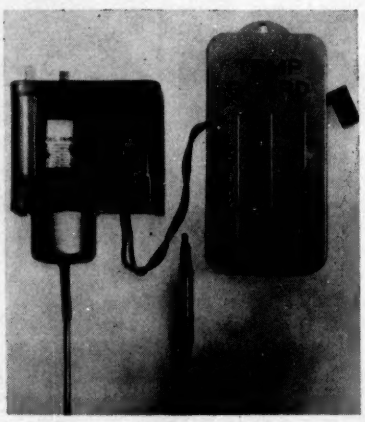
For extremely large capacities, two or more "Wintermatic" systems may be used in parallel on one Dricon Condenser. In all applications, receivers must be properly sized to hold a full charge of liquid, which could build up in the condenser during the control cycle.

No longer necessary are large expensive dampers, which are limited in the amount of control, having a small adjustment range and are affected by prevailing winds.

Complete information on Recold's new "Wintermatic" controls may be obtained by writing Recold Corporation, 7250 East Slauson Avenue, Los Angeles 22, California.

Refrigeration Failure Alarm

A NEW alarm system giving both visible and audible signals of refrigerator case failure, has been introduced by Richmond Refrigeration Service, Inc. of Staten Island, N. Y.

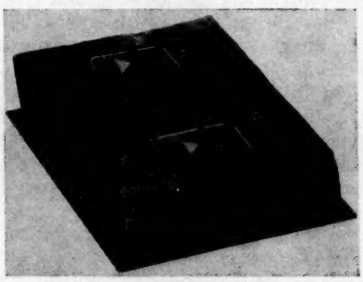


Called Temp-Guard by its manufacturer, the unit sounds a warning buzzer and raises a mechanical flag when temperature in a refrigerated chill room rises above safe levels. A time delay feature prevents the alarm from operating during normal defrosting periods or during short duration temperature rises. Consisting of a heat sensing unit, a control thermostat and the alarm unit, the device is easily installed and requires only minimum maintenance. The alarm unit can be mounted at room being protected, or in the case of multiple installations the alarm units can be mounted on a central control panel. Low voltage operation, two flashlight batteries or a step down transformer from house current, provide for simplicity in electrical wiring and hook-up of the device.

Temp-Guard systems also function as a pre-warning device to notify of inefficiency or malfunctioning of the refrigeration equipment. If the alarm sounds during the normal defrosting period it is indicative of mechanical problems in the cooling system which hinder prompt lowering of temperatures to a safe level.

Insul-Pin Method Speeds Up Installation Of Insulation

AN improved, time-saving method of permanently attaching interior and exterior insulation to metal has been developed by engineers of Omark Industries, Inc., Portland 22, Oregon.



Called the Omark-Graham Insul-Pin Stud Welding System, the new method offers rapid, secure fastening of regular and high temperature insulation to galvanized ductwork, aluminum ducts, industrial furnaces, refrigeration room facings, corrugated iron and steel plate.

A simple, three-step process does the job: (1) Omark-Graham pointed Insul-Pins are welded to the metal surface; (2) the insulation is pressed onto the pointed tips of the pins; (3) insulating material is secured with push-on clips.

Special features are numerous. Lightweight welding guns and portable welding machines make it possible to work in cramped quarters. Patented stud tip and instantaneous arc insure no-burn, no-distortion welding, even to thin sheet metal. New system eliminates need for flux, ferrules, inert gas, special wiring or special metal preparation.

New Stand And Carrier For Isotron Cylinder

PENNSALT Chemicals Corporation is providing maintenance men who use Isotron refrigerants in 22- and 25-lb. cylinders with a new device to make their jobs easier. Each Isotron cylinder in this size is now equipped with a Handi-Stand, a combination stand and hand carrier which replaces the plain protective cap and is a permanent part of the cylinder. The device becomes a built-in stand and is also well-designed hand grip for moving cylinders from place to place.

"We are constantly looking for ways to make the maintenance job easier," says Arnold E. Blitz, manager of Pennsalt's Isotron-Refrigerant sales. "In the short time that the new stand has been available, reception from the men in the field has been extremely gratifying."

Frozen Food Packers Elect New Officers

»» THE National Association of Frozen Food Packers, at their Annual Convention in Chicago, elected new officers and directors for 1960.

Elected as president for the coming year was William F. Edwards, executive vice president of Pasco Packing Co., Dade City, Florida, one of the largest frozen juice concentrators in the world.

Elected as 1st vice president was James S. Lawless, president, Frosted Fruit Products, Los Angeles, California. Elected as 2nd vice president was Norman L. Waggoner, treasurer, Olney & Carpenter, Inc., Wolcott, New York.

Elected to the Board of Directors were the following:

James R. Agen, president, Cascade Frozen Foods, Inc., Burlington, Washington

Clarice R. Cedergreen, president, Evergreen Frozen Foods Co., Snohomish, Washington

Vernon Gross, sales manager, Spiegl Farms, Inc., Salinas, California

Leon C. Jones, vice president, J. R. Simplot Co., Caldwell, Idaho

J. O. Tankersley, president, Winter Garden Freezer Co., Inc., Bells, Tennessee

George E. White, assistant general manager, Birds Eye Div., General Foods Corp., White Plains, New York

NAFFP's immediate past president, Harold J. Humphrey, formerly research director of General Foods Corp. has resigned from the board of directors to take a position with UNICEF, the United Nations International Children's Emergency Fund.

Lawrence S. Martin, secretary-manager of the Association was continued in office.

Single Manhole Transport Tanks May Be Seven Feet Longer

»» EFFECTIVE on July 5, 1960, automotive milk transportation tanks with single manholes may be seven feet longer than at present, and still comply with 3-A Sanitary Standards.

That's the effect of an amendment to the 3-A Sanitary Standards for Stainless Steel Automotive Milk Transportation Tanks for Bulk Delivery and/or Farm Pick-up Service, approved March 2 at the regular semi-annual meeting of the 3-A Committees, held in Athens, Ga.

Under present 3-A Standards, either end of a transportation tank shall not be more than 15 feet from a manhole opening; under the amended version, the ends shall not be more than 18'6" from the manhole. The amendment, considered by the 3-A groups to be thoroughly justified because of improved cleaning methods in the industry and by state highway legislation which provides for longer trailers, will permit larger over-the-road tank capacities for single manhole tanks.

The amended 3-A Standard will be published in the April 1960 issue of The Journal of Milk and Food Technology, and manufacturers may apply to the 3-A Symbol Council in July for authorization to place the 3-A Symbol on tanks complying with the amended length.

3-A Sanitary Standards are recommended by committees representing sanitarians and public health officers, equipment makers, and dairy processors. In general, equipment bearing the 3-A Symbol is acceptable in nearly all health jurisdictions in the United States and Canada.

Top DISA Posts Named At Group's 41st Meeting

»» R. O. DAVISON, The Kelco Co., was elected president of Dairy Industries Supply Association, succeeding D. G. Colony, Manton-Gaulin Manufacturing Company, Inc., who was advanced to Chairman of the Executive Committee, as the 41st Annual Meeting of DISA closed April 1, at the Edgewater Beach Hotel in Chicago.

Paul K. Girton, Girton Manufacturing Company, was elected vice president.

Roy E. Cairns, Waukesha Foundry Company, was re-elected treasurer.

DISA officers are elected annually by its 18-man board of directors, six of whom are elected annually for three-year terms. This year, because of a vacancy on the board, seven directorships existed to be filled, and in the election held March 31, three men won new places on the governing body.

The three new directors: John J. Weldon, Bessire & Co., Inc., Jobbers Commodity Director; Joe A. Larson, Sparta Brush Co., Inc., General Commodities and Services Commodity Director; and M. Carter Strickland, Smith-Lee Co., Inc., Containers Commodity Director.

The four incumbents who were re-elected are: At-large Directors Howard H. Cherry, Jr., Cherry-Burrell Corporation, and R. E. Olson, Taylor Instrument Companies; At-large Director for the Western Area Sherman C. Little, Sr., Weber Showcase & Fixture Co., Inc.; and Ingredients Commodity Director R. O. Davison.

Total registration at the session was 204.

Reflectal Offers Book On Reflective Insulation

»» A COMPREHENSIVE technical data book on reflective insulation has been announced by Reflectal Corporation, subsidiary of Borg-Warner Corporation, Chicago, Illinois.

Called "The Story of Reflective Insulation," the 28-page book presents the latest available information on techniques of industrial insulation.

A clear explanation of the dynamics of heat transfer, thermal efficiency and condensation is provided by the booklet. Drawings and text simplify the mechanics of the three basic methods of heat transfer, convection, and conduction. Charts and tables show the comparative thermal efficiency of modern insulation materials. National Bureau of Standard evaluations of leading insulations are listed.

The book gives a comprehensive explanation of condensation—how moisture forms and how to prevent moisture damage. The resistance provided by various insulation materials to vapor transmission is evaluated.

"The Story of Reflective Insulation" is particularly handy for architects and building contractors. It provides standard architectural specifications, "open" specifications for all insulations and techniques for installing insulating materials.

"The Story of Reflective Insulation" is available without charge from Reflectal Corporation, 200 South Michigan Avenue, Chicago 4, Illinois.

New Corporate Symbol For Mueller Brass Co.

››› FRED L. Riggin, Jr., executive vice president of the Mueller Brass Co., Port Huron, Michigan, and A. C. Dappert, vice president in charge of sales, left, examine the striking new corporate symbol recently adopted by the company. The new symbol, a block "M", with an inverted triangle over the center, is a modernized version of the symbol that has represented the Mueller Brass Co. since its organization over 40 years ago.

Mueller Brass Co. has been a major fabricator of non-ferrous metals since the First World War when it was founded to produce brass forgings for the armed forces. Today, Mueller Brass Co. is one of the most diversified manufacturers in the country. In addition to brass, bronze and aluminum forgings, Mueller Brass Co. produces impact extrusions, brass rod, screw machine products and castings, plastic moldings, pipe and custom extrusions. Mueller Brass Co. is also a major supplier of copper tube, fittings, valves and accessories to the plumbing and heating industries. The company also produces a wide range of component parts used in refrigeration and air conditioning.

In speaking of the new symbol, Mr. Riggin said that it would serve to identify the diverse products of the Mueller Brass Co., as well as the many products of the wholly owned Mueller Brass subsidiaries.

Bronze Branch Outlet Finds Industry Use

››› A BRONZE branch piping and tubing outlet that was developed as a war baby during the Korean hostilities to speed marine construction is now finding wide application in plumbing, heating, process piping and in other fields.

The bronze socket brazing and threaded outlets—called Brazolets—were developed by Bonney Forge and Tool Works, Allentown, Pa., to help speed the installation of non-ferrous piping in non-magnetic minesweepers needed in Korea.

Designed for silver brazing to copper, brass or copper-nickel pipe or tubing, the Brazolet has a funneled inlet for improved fluid flow and a bonding surface at least three times the thickness of that of the pipe or tubing.

Bonney claims that the Brazolet saves money, time and material in the fabrication of original installations and in the addition of outlets within existing systems:

The unit price of the Brazolet is less than that of other fittings, such as the reducing tee—substantially less, when the run pipe size exceeds 2 inches and the branch pipe is half the run size or smaller. Fabrication time is reduced because the run pipe can be installed in random lengths and the branch joints cut in afterwards.

Unit fabrication cost is reduced because of less silver used and less heating. Example: 4 x 1 Brazolet —one 1" joint compared to two 4" joints or a total of eight-to-one.

Brazolets are installed by cutting a hole in the run pipe with a drill or hole saw, fluxing the surface of the run around the hole as well as the bonding surface of the Brazolet, heating the joint to proper temperature and touching the silver brazing rod to the joint. The accuracy of the machined curvature at the base of the Brazolet provides for an instantaneous fully bonded joint that is stronger than the pipe to which it is attached.

Bonney's test summary on Brazolets show that hydrostatic pressures of 1900 pounds per square inch were attained in copper tubing and 13,000 psi in pipe. A series of impact tests resulted in complete distortion of the pipe and fitting without fracture of the silbrazed joint.

Brazolets are manufactured from valve bronze which conforms to ASTM B61 and MIL-B-16541. They come in outlet sizes ranging from 1/4" to 4" and are manufactured as threaded or silbraze socket outlets. Bonney Forge has available from stock IPS run diameters 12" and smaller with each of the following types of outlets: Type TP silbraze socket, MIL-F-1183, silbraze socket and threaded. Also stocked are types K, L and M run diameters 6" and smaller for each of the following types of outlets: K, L and M silbraze socket outlets and threaded outlets.

Installation instructions and complete literature on Brazolets are available from Bonney Forge and Tool Works, Allentown, Pa.

Machinery Mounts Described In Bulletin

››› ALL types of machinery mounts are described in a six-page bulletin published by Unisorb, 210 South Street, Boston 11, Massachusetts. Describes three basic types: Unisorb Pads, Unisorb Level-Rite and Unisorb Level-Rite "UL", tells how they control vibration, simplify and reduce costs of machine installation, permit easy machine re-location, and allow machines to operate at higher speeds and perform more accurately. Also includes data on loading ranges, vibration transmissibility, and how to use Unisorb cement to "anchor" machines when heavy side thrusts or reciprocal action is a problem. Details on a new "do-it-yourself leveling mount" also included. Bulletin is available from Unisorb, Department WCH, 210 South Street, Boston 11, Massachusetts.

Kuklinski of Carrier Promoted

››› HENRY W. Kuklinski has been named engineering manager for transportation air conditioning and refrigeration equipment at Carrier Corporation. Urban H. Johnson, manager of military and special equipment department, announced the appointment.

Mr. Kuklinski has been with Carrier since 1952 and was formerly senior development engineer in the transportation department. He succeeds James Swinburne, who was named division staff engineer.

Armstrong Contracting Elects New Officers

››› F. D. RUPPRECHT has been elected a vice-president of the Armstrong Contracting and Supply Corporation at the organization's annual meeting in Lancaster, Pa. Rupprecht is district manager of the company's Baltimore district office.

J. W. Liddell was re-elected president, E. D. Ainslie, Jr. of Philadelphia and A. J. Stream of Seattle, vice-presidents, and E. W. Hines, Jr., secretary-treasurer.

The corporation, a wholly owned subsidiary of the Armstrong Cork Company, was formed in 1958 to handle the company's contracting operations, particularly in the field of insulations. It provides consultation for architects and engineers during the design and engineering stages of insulating projects, and assists them in selecting particular types of insulation for specific temperature ranges.

Merchants Refrigerating Co. Constructing New Warehouse

››› GROUND breaking ceremonies for the construction of Merchants Refrigerating Company's refrigerated warehouse and Frozen Food Center took place recently on a site located at Fifth Street north of Secaucus Road, Secaucus, New Jersey. Company officials present were Arthur N. Otis, chairman, James W. Straub, president, Clive C. Berkley, vice president in charge of engineering, Paul V. Sullivan, vice president in charge of sales, and the Honorable James F. Moore, Mayor of Secaucus.

The project is scheduled for completion in the spring of 1961.

The initial construction will consist of a one-story warehouse 410' x 525' over-all and a separate building 60' x 104' to serivce and maintain the transportation equipment owned and operated by Howell Trucking Co., Inc., a wholly owned company subsidiary. The warehouse building will contain 3,168,000 cubic feet of refrigerated space to be maintained at a temperature of five degrees below zero. The exterior walls will be exposed masonry, except for a portion of the second floor area which will be of insulated porcelain enamel panels in extruded aluminum frames.

Arthur N. Otis, chairman, stated, "this facility is the newest development in the company's program to serve its customers with the most advanced methods and the greatest efficiency in the handling and movement of perishable products".

Approximately eight acres of the 25-acre site will be available for tenant-processors facilities, which will be erected to customers' specifications. The interrelated facilities for processing and/or distribution is one of the unique features of the Frozen Food Center.

The warehouse and the processors' buildings will be served by the Erie Railroad, which provides direct service to the West and North, and interconnects with every major rail trunk line serving the metropolitan New York area.

Preliminary grading on the site is underway and an access road to serve the property, nearly a mile in length, is being completed.

Abbott, Merkt & Company is the architect-engineer. Turner Construction Company will be the general contractor for the erection of the building. V. C. Patterson & Associates, Inc., engineers, will design the refrigerating system.

Merchants Refrigerating Company with executive office at 17 Varick Street, New York, N. Y., has warehouses in New York City; Jersey City and Newark, New Jersey; Buffalo, New York; Vinta Park, Missouri; Hopkins, Minnesota; Modesto and Santa Clara, California.

Waterloo Catalog Gets Certificate Of Merit

››› THE Producers' Council, Inc. of Washington, D. C. has awarded a Certificate of Merit in the 1960 Building Products Literature Competition to a comprehensive air diffusion equipment catalog published by Waterloo Register Company, Inc. The award, presented at the American Institute of Architects' convention in San Francisco on April 18, was made for "an outstanding effort in the production of informative, high quality product literature."

This 58 page catalog contains complete application and specification data on Waterloo's line of return and supply registers, extruded aluminum Airline grilles, removable core grilles, volume control dampers and door

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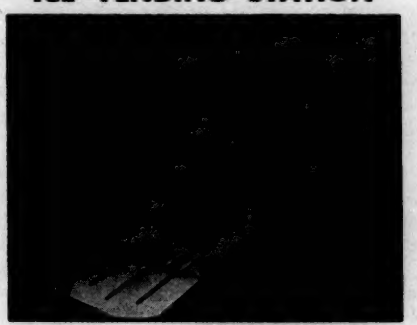

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ventilators. Each type of unit is well illustrated and keyed in color for quick reference.

Copies of this catalog are available from Waterloo Register Company, Inc., P. O. Box 72, Waterloo, Iowa.

Bulletins On Motors

››› WAGNER Electric Corporation, St. Louis 33, Mo., has issued two new Bulletins on motors. "Prime Partners"—Bulletin MU-244 describes doubly-protected drip proof and totally-enclosed polyphase squirrel-cage motors, 1 hp and larger, with NEMA "C" faceplates for close-coupled centrifugal pump applications. Bulletin covers, by use of cut-away photo, the particular electrical and mechanical features of the motors that make them prime working partners with close-coupled centrifugal pumps.

"Quiet"—Bulletin MU-245 lists motors, 1/6 through 10 hp, available with resilient mountings. The larger ratings were recently developed to meet the demands of manufacturers of central air-conditioning units, who require ultra-quiet equipment operation for locations such as hospitals, churches, radio and television studios, theatres, and similar locations. Bulletin covers the mounting construction and various "whys" and "wherefores" of quiet motor operation.

Recold Revised Catalog For Multizone Units

››› A COMPLETELY revised catalog for multizone air conditioners has been announced by Recold Corporation.

The new catalog, #55C9a, includes complete engineering data, dimensions and specifications for the entire series of Multizone Units, which are equipped for simultaneous heating and cooling applications. Multizone units are available with capacities from 1650 to 29,000 cfm. Modular construction permits a wide choice of arrangements, motor locations, and accessories for either horizontal or vertical models.

The V-UHT air conditioning units are offered in either Class I or Class II construction. Class I construction features large, slow-speed blowers for quiet operating ranges. Class II units are designed for high-pressure systems, containing backward-curved wheels, larger shafts and bearings, and heavier frames, all available for use on applications covering up to 6" total static pressure.

Zone dampers for Multizone units are placed at a 45° angle, so that ducts may be taken off either horizontally or vertically. Recold's spreader plate is designed for even air distribution over the entire surface of the cooling coil for proper operation.

Copies of the new Multizone catalog are available by writing Recold Corporation, 7250 East Slauson Avenue, Los Angeles 22, California.

Vilter Appoints H. C. Melms Manager Of Order Dept.

››› HERMAN C. Melms has been named manager of the order department of The Vilter Manufacturing Company, Millwaukee, Wisconsin manufacturer of commercial refrigeration and air conditioning equipment.

Previously assistant manager of the department, he fills the vacancy created by the recent death of E. F. Fredrichsdorf.

Melms has been a member of the Vilter order department since 1956 and is the fourth generation of a family whose continuous line of service dates back to the founding of the company in 1867.

Air Conditioner Bulletin

››› A NEW 4-page 8-1/2 x 11 illustrated 2-color bulletin (8625) describing the new line of American-Standard packaged multi-zone air conditioners is now available from American-Standard Industrial Division, Detroit 32, Michigan.

The new bulletin illustrates and describes both the single-zone basic unit and the multi-zone design. Simple line drawings are used to illustrate available arrangements and location of basic elements.

Design features are itemized and described in detail in Bulletin 8625. Basic specifications and dimensions are also tabulated.

Pennsalt Chemicals Assigns Isotron Sales Territories

››› E. SMEDLEY WARD, Jr. and Homer B. Greetham have been given new Isotron sales assignments by Pennsalt Chemicals Corporation. Announcement of the assignments was made by F. A. Lucard, manager, Isotron Chemicals Department.

Ward, a graduate of Dartmouth College with a B.A. degree in Chemistry and previously Isotron sales representative in Cleveland, has been assigned to the New York territory. Before joining Pennsalt in 1957, he was a sales representative for the Gulf Oil Corporation in Philadelphia. A veteran of World War II and the Korean War, he served as a U. S. Navy Commander with a unit which received a Presidential Citation.

Greetham will be serving aerosol contract loaders, aerosol vendors, and

original manufacturers of refrigeration equipment in a territory which includes Ohio, northern Kentucky, and lower Michigan.

He attended the University of Arizona. He served as a Technical Sergeant in the U. S. Army during World War II. Before joining Pennsalt's Isotron Department this year, he was employed in sales and product development for the Cleveland Electro Metals Co.

Greetham is a member of the American Institute of Mining and Metallurgical Engineers and the American Foundryman's Society. He lives in Sheffield Lake, Ohio with his wife, Lenore, and two children.

Worthington Opens Factory Wholesale Operation

››› D. J. MICHELSON, Washington zone manager of Worthington Corporation's air conditioning and refrigeration division, announces the establishment of a direct factory wholesale operation headquarters in Washington, D. C.

Supervising the new wholesale operation will be T. J. Driscoll, who has been Worthington's representative in this region for the last 3 years.

Mr. Michelson stated that this reorganization will offer better service and more flexibility to air conditioning dealers and contractors. Worthington will provide application engineering and service assistance, local warehousing and closer contact.

The following counties will be covered: Montgomery, Loudoun, Fauquier, Prince William, Stafford, Charles, St. Mary's, Calvert, Prince Georges, Fairfax, Arlington, District of Columbia and Alexandria.

Export Office Established By Cincinnati Sub Zero

››› A SEPARATE office to handle foreign sales and export operations has just been established at 224 East Eighth Street, Cincinnati Ohio, announced R. J. Jacobson, president of Cincinnati Sub Zero Products.

H. E. Schurgast, who has worked almost exclusively in foreign trade since the close of World War I, has been appointed export manager. He is a native of Berlin, Germany, and has been a resident of Cincinnati since 1938.

Cincinnati Sub Zero Products manufacture low temperature production chilling and environmental testing chambers for use in metalworking, research, medicine, agriculture and many other fields.

During it's twenty years of business, Cincinnati Sub Zero Products has exported many chambers to Canada, Europe and South American countries. Recently a shipment of special chambers was delivered to India, and currently in manufacture is a large order destined for Brazil. The new export office is needed to facilitate handling of steadily increasing demands in the foreign markets and is expected to considerably increase the total company business in 1960.

Creamery Package Promotes D. C. Roahen

››› DAN C. Roahen has been promoted to director of research of The Creamery Package Mfg. Company, Chicago, manufacturer of food processing, refrigerating, and materials handling equipment and bulk farm cooling tanks, according to a recent announcement by the firm's president, E. B. Lehrack. Mr. Roahen will continue to headquarter at Fort Atkinson, Wisconsin.

Mr. Roahen graduated from Ohio State University with a B.S. degree in Dairy Technology, and received an M.S. degree in Dairy Industry from the University of Wisconsin.

Following practical experience in general dairy processing operations with a nationally known company, Roahen joined Creamery Package in 1939 and completed the company's training program.

He then worked as a sales engineer in the firm's Chicago Branch; later handled priorities and government regulations; was transferred to production control at CP's Fort Atkinson, Wisconsin plant; and in 1949 was assigned to the research department. In 1957 he was made senior research engineer from which position he has just been promoted to director of research, succeeding A. H. Wakeman, who has been elected vice president in charge of engineering and research.

Dean Panelcoil Bulletin

››› NEW Dean Panelcoil Technical Data Bulletin M-9 has just been issued by Dean Products, Inc., 1048 Dean Street, Brooklyn, N. Y. Examples are given showing heating and cooling of all types of tanks, troughs, mixers, and air duct systems. Also shown are applications where Dean Panelcoil has become part of the equipment itself, as in a percolator for a brew kettle, a radiant shield for a high temperature furnace and an open-top S.S. mixing tank. This bulletin is available on request.

Classified Advertising

Position and Help Wanted

WANTED—Ice Plant operating engineer. Must be experienced with ice making plants operating with ammonia compression system. Write or call Mr. J. H. Rustman, Jefferson Ice Co., 6625 Avondale Ave., Chicago 31, Ill. Phone SP 4-3300.

WANTED—Operating Engineer, Jr. or Sr. Long Island food plant has excellent opportunity for man with full knowledge of large tonnage, very low temperature 2-stage ammonia refrigerating systems, liquid transfer pumps, etc. Send resume and salary desired to Box MR-8 c/o Industrial Refrigeration.

USED EQUIPMENT—wanted & for sale

FOR SALE—Two 14x12 Frick compressors with 500 h.p., 4000 V. electric machinery, package type synchronous motors (1 used; 1 never used). One 13800 to 4000 V transformer; 8-25 KW, 220 V., 3 phase, 60 cycle electric ILG heaters with controls. Gerard Freezer & Ice Co., 325 North St., Boston, Mass.

FOR SALE
(2) 11x9 York compressors.
10x10 York V-belt driven.
9x9-7½x7½ & 5x5 York compressors.
(2) 60 h.p. G. E. motors 900 rpm. w/controls.
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Advise Us Your Needs
Use QUICKSEAL—stops brine tank leaks.
Use CLERTEMPICE—clears and tempers ice.
Born Company 80 East Jackson Boulevard.
Chicago 4, Illinois. WAbash 2-3290.

FOR SALE—One used Halstead Mitchell cooling tower, Model WT 3014, with 112 gallon make-up tank. D. Kelton, 5746 Broadway, New York 63, N. Y.

FOR SALE—AMMONIA EQUIPMENT
2— 15 ton Frick ice making plants (New).
1— 300 lb. Gifford Wood ice cubing machine.
1— 11"x13" 4-cyl. York Duplex DC to 250 h.p. motor.
2— 10"x10" 4-cyl. Carbondale Duplex DC to 225 h.p. motor.
3— 10"x10" 4-cyl. Frick Duplex DC to 175 h.p. motor.
1— 9"x9" 4-cyl. York Duplex DC to 150 h.p. motor.
4— 10"x10" 2-cyl. York DC to 100 h.p. motor.
1— 9"x9" 2-cyl. York DC to 75 h.p. motor.
2— 10"x10" 2-cyl. Yorks with V type flywheel.
1— 9"x9" 2-cyl. York with V type flywheel.
2— 7½x7½ & 8½x8½" 2-cyl. Vilters.
3"x3", 4"x4", 5"x5" & 6"x6" York and Frick compressors.
3"x3", 4"x4" & 5"x5" York condensing units.
6— York floor type blower unit coolers.
11"x22"x47" 300 lb. ice cans.
75, 100, 150 & 200 ton ice making plants.
3— shell & tube condensers, 25 ton capacity.
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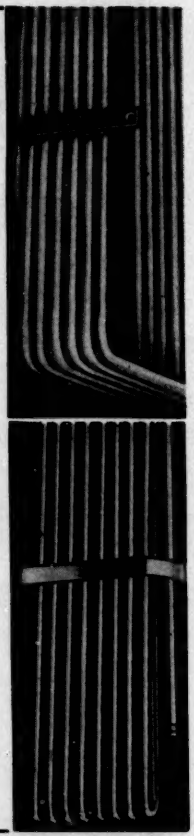

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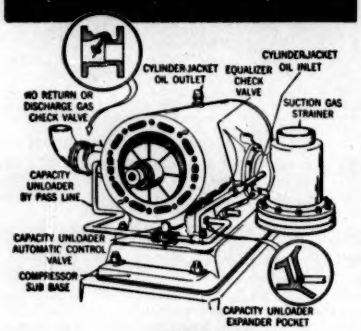
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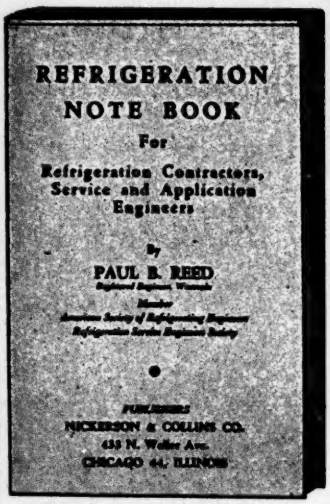
by PAUL B. REED



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THIS NOTE BOOK of condensed refrigeration information represents many years of work in accumulating practical data—"culling out" all extraneous material—so as the author states, "the reader will find a handy and easily carried source of information not usually kept in memory."

You will be surprised at the wealth of material that has been included in this convenient and practical reference Note Book. It is written in layman's language, without complicated formulas. In short, it is a tool responsible for the operation of refrigeration equipment.

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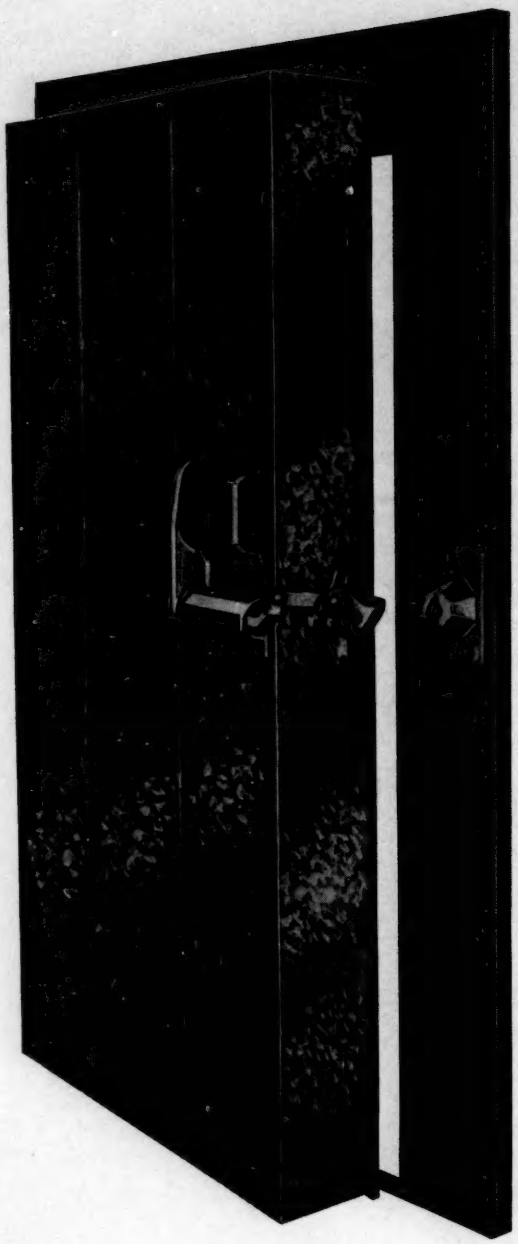

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